Management for Commercial Banking
Professor Jitendra Mahakud
Department of Humanities and Social Sciences
Indian Institute of Technology, Kharagpur
Lecture 27
Use of Derivatives in ALM - II

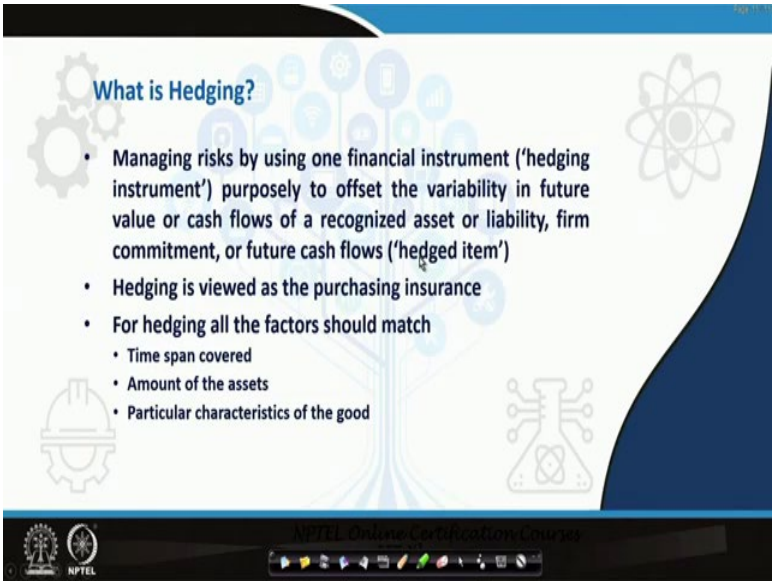
Good morning. So, in the previous class we discussed about the basics of the derivatives instruments, and what are those nature of the instrument like futures, options, swaps and all these things. And today we will be discussing about the use of the derivatives instrument mostly from the commercial banking perspective.

(Refer Slide Time: 00:34)

And the most important use of the derivatives instruments are hedging. So, whenever we talk about the hedging that we have two types of hedge always you observe. One is your long hedge, another one is the short hedge. Long means buying, short means selling.

So, these are the two types of major hedging process which works in the financial system and today we will be discussing how these two types of hedging concept is used by the commercial banks to manage their interest rate risk in the market depending upon the different conditions.

(Refer Slide Time: 01:16)



So, let us see the definition of hedging. What is the meaning of hedging? The meaning of hedging is basically what? It is the management of risk by using one financial instrument which is called the hedging instrument with some kind of objective obviously to offset the variability in future value or the cash flow of a recognized asset or the liability or the firm's commitment or the future cash flows, what basically the firm is going to be, going to hedge.

That means they are using one particular instrument to hedge the risk or hedge the fluctuations what they are expecting to come in another segment of the market. So, they are using one asset which can hedge out the risk what they may incur or they may face in a particular segment but if they take a reverse position in other markets then that particular risk can be nullified or can be phased out and finally the total value of the portfolio of that particular entity will be intact. That is the basic nature of the hedging.

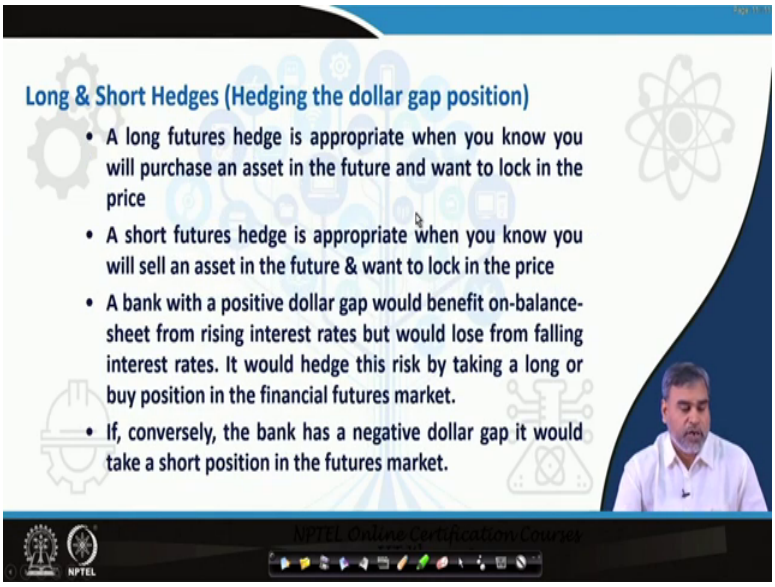
So, some people consider hedging is basically a purchasing insurance. So, whenever we talk about hedging we basically talk about we are buying something or we are trying to do something. By that our total risk can be hedged out because we have the different positions in the different segments of the market. So, for hedging there are certain things we have to consider.

What is the time period? Time periods will be perfectly matched between the two different entities. The amount of the assets that what is the asset, how much asset specifically you want to hedge out and the characteristics of the good, what is the underlying asset? That also have

to be considered because the value of that particular underlying asset also change on the basis of the nature of the assets.

So, these are the different characteristics or different things what we have to keep in the mind whenever we are trying to go for hedging of a particular asset to get rid of any kind of risk in the financial system. So, this is the way the hedging is defined. But let us see that how that particular concept works.

(Refer Slide Time: 03:55)



Already we have discussed that there are two types of hedge, two types of hedging process which works. One is long, another one is short. So, whenever you define this long hedge and short hedge, what it exactly means? A long future hedge is appropriate when you know you will purchase an asset in future and want to lock in the price. What is long hedge? You want to buy something in the future.

Let you want to buy any kind of commodity in the future or any kind of asset in the future and you are expecting that the price will be much more higher whenever you are, or the market price will be much more higher whenever you are going to, or you are planning to buy that particular assets.

So, what basically you are trying to do, to get rid of that particular higher price you are now locking that particular price by taking a position, buying positions in the future. So, that is called the long future hedge. And other one is short future hedge. What do we mean by the short future hedge? The short future hedge is appropriate, when you know you will sell an asset in the future. You want to sell one asset in the future.

Let you are growing potato. You want to sell potato in the future once the harvesting season will be over. So, the harvesting season will be over, anyway you are going to sell the potato. Then obviously you know that in the market price on that day will be lower than what you are expecting, what you want to, at what price you want to sell it.

Then you want to lock your price by taking one particular contract. Let you want to sell it at price of 10 Rupees per kg but you are expecting that on that day market price may be, will be less. So, to get rid of that particular thing you are locking the price at price of 10 in today but the particular commodity will be sold may be after 2 months or after 3 months. So, that is the way the long future hedge and short future hedge are defined.

While considering from the banking perspective how basically this concept works? So, a bank with a positive dollar gap, you know what do you mean by positive dollar gap. That means your rate sensitive assets are more than the rate sensitive liabilities, would benefit on balance sheet from rising interest rate but they can lose if the interest rate is declining.

Already you know that, if rate sensitive assets are more than rate sensitive liabilities, then we have positive dollar gap. If the interest rate is increasing, your net interest income is increasing, but if your interest rate is declining then your net interest income is declining.

And how the bank, for example already we know that the prediction of interest rate is the most risky strategy in the market. So, if the interest rate prediction is the most risky strategy in the market, bank may not accurately predict that what kind of interest rate is going to prevail in the market? In that particular point in time what the bank should do?

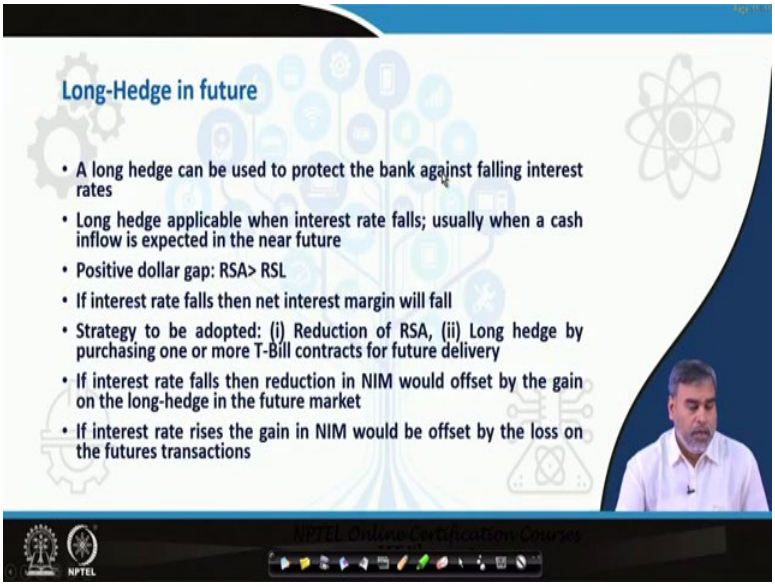
The bank would hedge this risk by taking a long or the buying position in the future market. If it is a positive dollar gap then they can take a buying positions or the long future hedging positions in the future market to hedge the risk, what basically, that means we were doing?

If you are buying certain kind of instruments in the future at a certain price, if the interest rate goes up, we are losing there but we are gaining in the spot market because my net interest income is increasing. But with reverse also happens there I am gaining and here I am losing. At least the net effect is not going to affect my net interest margin or the commercial bank's net interest margin is not getting affected.

Conversely if the bank has a negative dollar gap it could take a short position in the future market because the negative dollar gap means if the interest rate is declining then they will

gain or the net interest margin will be increasing. If the interest rate is increasing then the net interest margin will be declining. So, that basically is related to negative dollar gap. Because of that the reverse position they have to take in the market if they want to hedge the risk in the particular system.

(Refer Slide Time: 08:38)



So, the long hedge if you talk about, in detail if you see how it basically works, so the long hedge is always used to protect the bank against the failing interest rate because if it is a positive dollar gap people use this long hedge.

So, why basically, if this interest rate is increasing there is no risk in the market, there is no risk for the bank because anyway the rate-sensitive assets are more than the rate-sensitive liabilities. So, their net interest margin will be increasing.

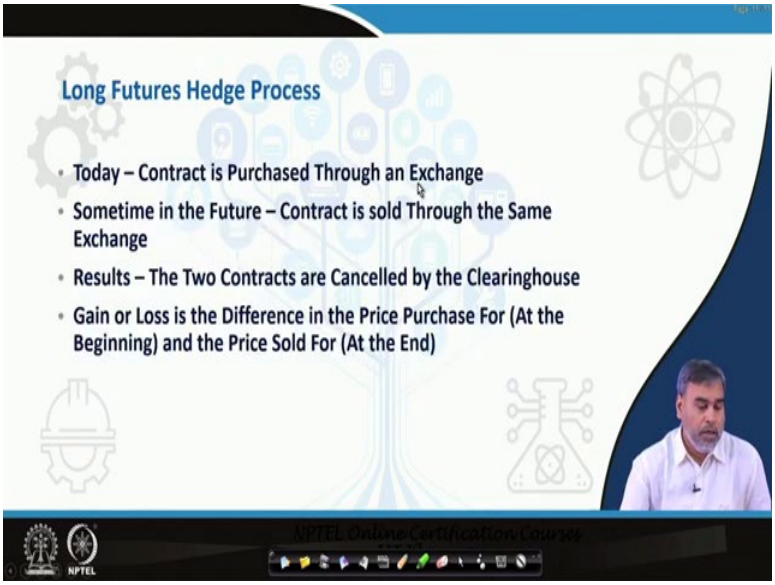
But if the interest rate falls then they will lose. So, to lock that particular risk what they are going to get if there is a, interest rate is going down, they want to take a long hedge positions in the system. So, that is why the long hedge can be used to protect the bank against the falling interest rates usually when a cash inflow is expected in the near future.

So, for example, if you say there is a positive dollar gap, rate-sensitive assets is more than rate-sensitive liabilities. So, if the interest rate falls then the interest margin will fall. So, what kind of strategy the bank can adopt at that particular point of time? They can reduce the rate-sensitive assets, one option. Second option, they can go for a long hedge by purchasing one or more T-bill contracts for the future delivery.

So, if the interest rate falls then there is reduction in NIM but which can be offset by the gain of the long hedge in the future market. So, the total net interest margin is not going to be affected, that is if the interest rate falls. Other condition, for example the interest rate rises, obviously they will gain because rate-sensitive assets are more in the spot market.

The rate-sensitive assets, because of more rate-sensitive asset there is a gain in NIM but that can be offset by loss from the future transactions because they have taken a buying positions in the future market. Because of that what happens, if there is interest rate rise, then they will lose in the future market but they gain in the spot market. Because of that the, again this particular risk will be nullified and they will be totally, completely minimize this interest rate risk in the system.

(Refer Slide Time: 11:16)



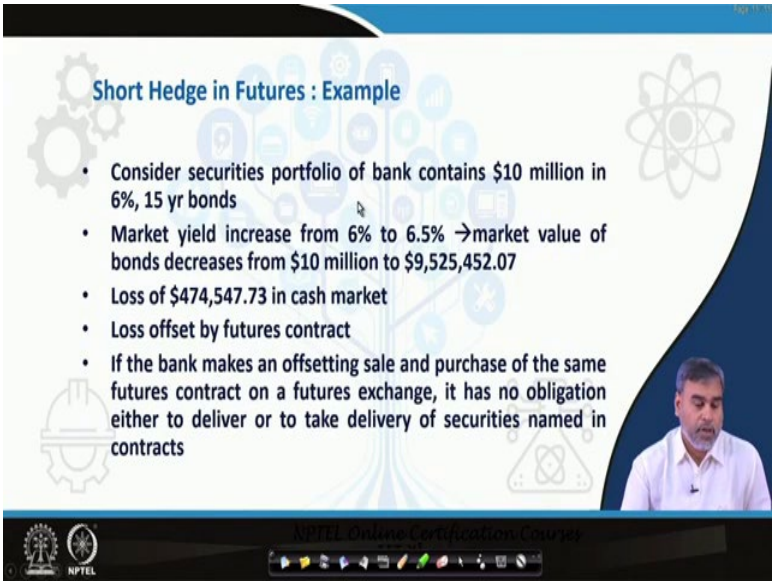
So, how this process basically works? Today the contract is processed through an exchange, sometimes in the future the contract sold through the same exchange; the two contracts are cancelled by the clearing house. Gain or loss is the difference in the price purchased for and price sold for at the beginning and at the ending. So, these are the practical process through which the long future hedge basically works in the system.

(Refer Slide Time: 11:48)

Short hedge, already we have explained that the short hedge is basically important for the banks who have a negative dollar gap. So, if there is a negative dollar gap then your rate-sensitive asset is less than the rate-sensitive liabilities. If interest rate increases then net interest margin will fall and there will be the gain in the short hedge position which will offset the loss in the spot market. If the interest rate falls, the increased NIM would be offset by the loss in the future contracts.

So, the opposite way basically it will work. Whatever way the long hedge will work, the reverse way the short hedge will work. The short hedging is important if any commercial bank has a negative dollar gap. And the long hedge will be important, or will be beneficial if the particular bank has the positive dollar gap.

(Refer Slide Time: 12:44)



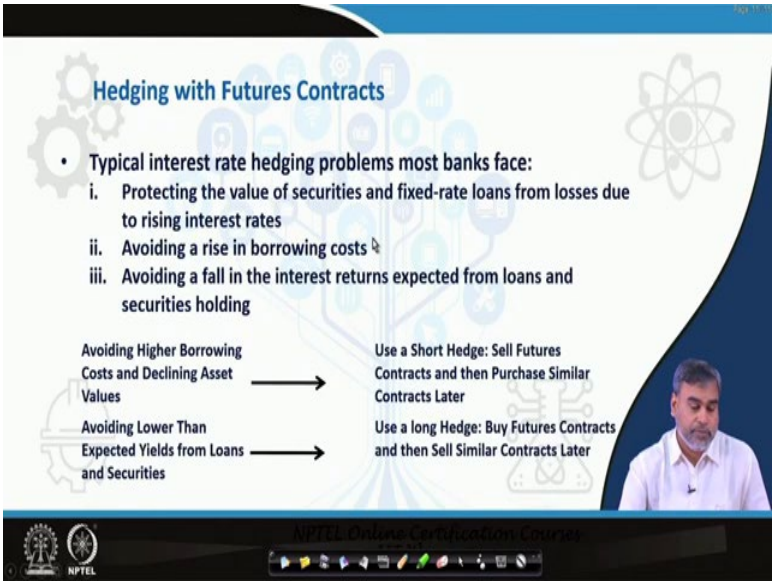
The example if you see that, here for the short hedge, consider securities portfolio of a bank contains 10 million dollar in 6 percent 15 year bonds, market yield increases from 6 to 6.5 percent. Then the market value of the bond decreased from 10 million to this, there is a loss of this much in the cash market, 474547.73 but the same loss can be offset by the short hedge positions whatever you have taken in the future market.

So, if the bank makes an offsetting sale and purchase of the same future contract in the futures exchange, it has no obligation either to deliver or to take delivery of the securities named in that particular contracts.

(Refer Slide Time: 13:32)

So, the same process like your long hedge process, today contract is sold through an exchange. Sometimes in the future contract is processed through the same stock exchange. Two contracts are canceled out by the future clearing house. Then gain or loss is difference in the price purchased for and the price sold for, at the end and at the beginning. So, that is the basic differences between these short hedge process and the long hedge process.

(Refer Slide Time: 14:01)



So, if you summarize that how basically it will work, the interest rate hedging problem mostly the bank face, so they want to protect the value of securities and fixed rate loans from losses due to rising interest rates because if they have a fixed rate loans, if there is a change in interest rate they cannot change the interest rate but they have to change the deposits and other rate.

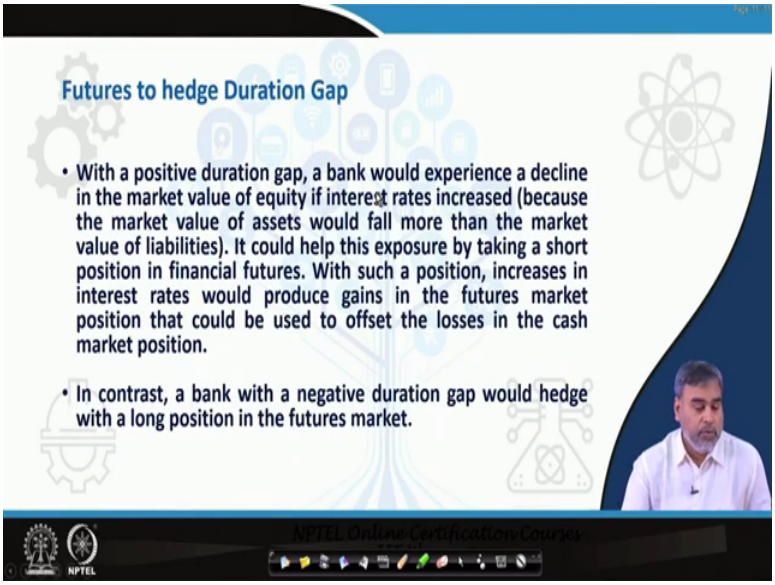
That is why the cost is increasing but the revenue generation or income is not increasing. They can avoid the rise in borrowing cost in the market because they can lock the interest rate from today. So, even if there is change in interest rate in the future they are not going to be affected by that. They can also avoid a fall in interest returns expected from the loans and the securities what they are holding.

So, if you want to avoid, or any commercial bank wants to avoid higher borrowing costs and declining asset values then go for a short hedge. Sell the future contract and then purchase the similar contracts later.

If they want to avoid the lower than the expected yield from the loans and securities then use a long hedge. Buy the future contracts and then sell the similar contracts later. So, this is the

way in practice the commercial banks basically use the future instruments for the hedging in that particular system.

(Refer Slide Time: 15:28)



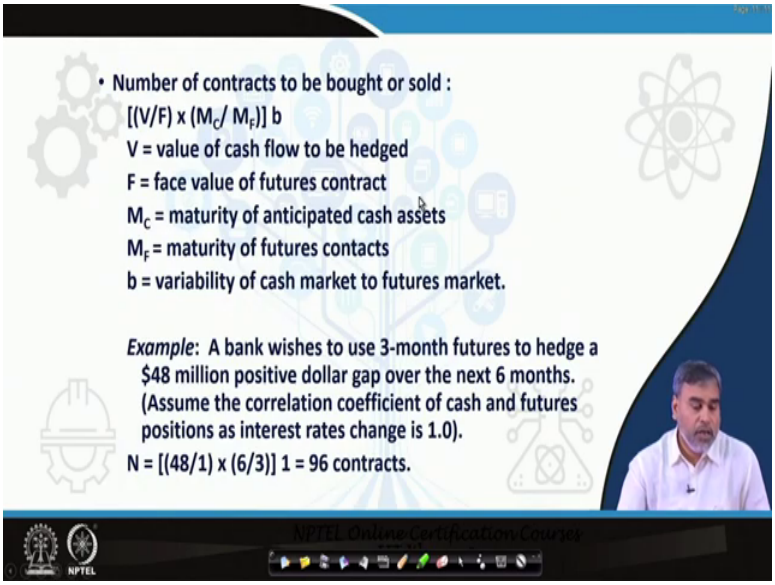
Then we have, we can also see it can be used for the duration gap also. So, the same way whatever way we have used for the dollar gap, so in duration gap also, with a positive duration gap a bank could experience a decline in the market value of equity. So, if the interest rate increased because the market value of asset will fall more than the market value of liabilities.

So, it could help this exposure by taking a short position in the financial future. So, with short position increases in the interest rates would produce gains in the future market. That could be used to offset the losses in the cash market position.

It is little bit reverse depending upon the positive duration gap we go for the short hedging. So, but for the positive dollar gap we go for a long hedging. So, in contrast, bank with a negative duration gap would hedge with the long position in the future market and the logic is basically the same way, whatever way we have understood about the positive duration gap.

So, this is the basically concept what we see that, whenever depending upon the different kind of dollar gap and the duration gap, the short hedge and long hedge positions are used to hedge the risk in the particular system.

(Refer Slide Time: 16:48)



Then how much contract if you are going for hedging, then how much contracts or units of contract you want to hedge out? So, this is the thing you have to remember that it is nothing but the V which is the value of the cash flow which has to be hedged, that means in the spot market positions, F is the face value of the future contract and your, MC here is the maturity of the anticipated cash assets and MF is the maturity of the future contracts and b is the, the relationship, the variability of the cash market to the future market, that means the correlation between the cash market and the future market.

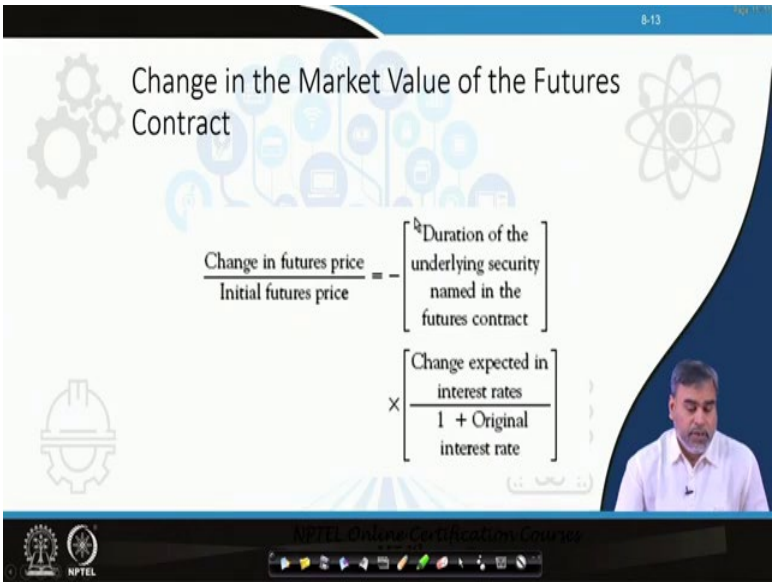
So, that means here $[(V/F) \times (M_C/M_F)]$ b, that basically gives you the number of contracts which has to be used to hedge the risk positions whatever you have in the spot markets by the commercial banks.

So, if a bank wishes to use 3 months futures to hedge a 48 million positive dollar gap over next 6 months, assume that the correlation coefficient of the cash and future market is 1 then your number of contract which has to be hedged out is, 48 million is the value of the cash flow, 1 is basically is considered the face value of the future contract, 6 is the maturity period for the maturity of the cash asset like here, in this we have considered about the maturity of the future contract which is, period is 3 months.

Then 6 by 3 into 1, that is the 96 contracts so the number of contracts which has to be hedged out, to interest rate risk in the market for the 48 million dollar that is basically 96 contracts. So, depending upon the change in the face value of the future contract and depending upon the change in the maturity period of the future contract and as well as the cash asset, this

particular number of contracts can change. So, this is the simplistic way of managing or finding out the number of contracts which are required to really manage this particular interest rate risk in the system.

(Refer Slide Time: 19:06)

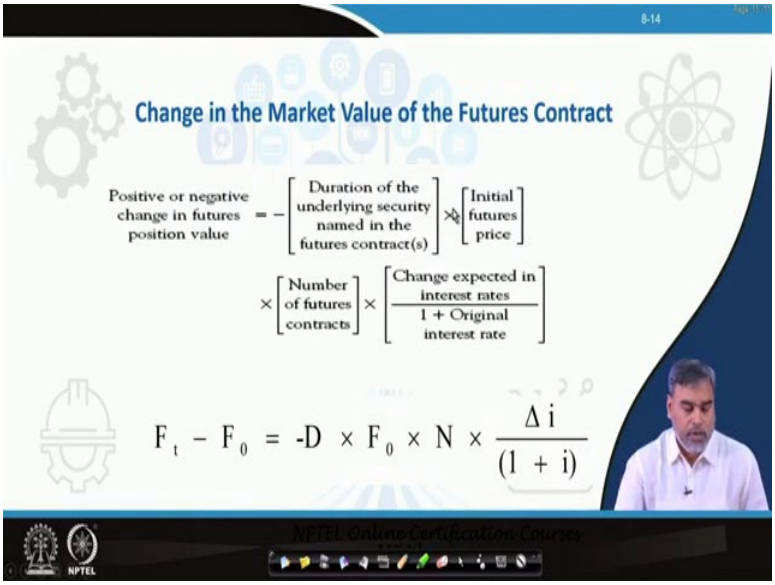


Then we have, if you talk about this that how we can calculate the change in the market value of the future contract if you see, so you remember this one, change in the future price upon the initial future price if you want out the change.

If you know the duration of the underlying asset and the future contract then you know the change in the interest rate and change in the original interest rate then how the market value of the future contract is going to be changed.

So, that is basically nothing but the minus of the duration of the underlying security named in the future contract multiplied by the change expected in the interest rate that is $\Delta i + 1 + i$. So, duration multiplied by the $\Delta i \times 1 + i$ - of the duration $\times i / 1 + \Delta i$ that will give you the how the market value of the future contract is going to be changed whenever there is a change in the interest rates.

(Refer Slide Time: 20:07)

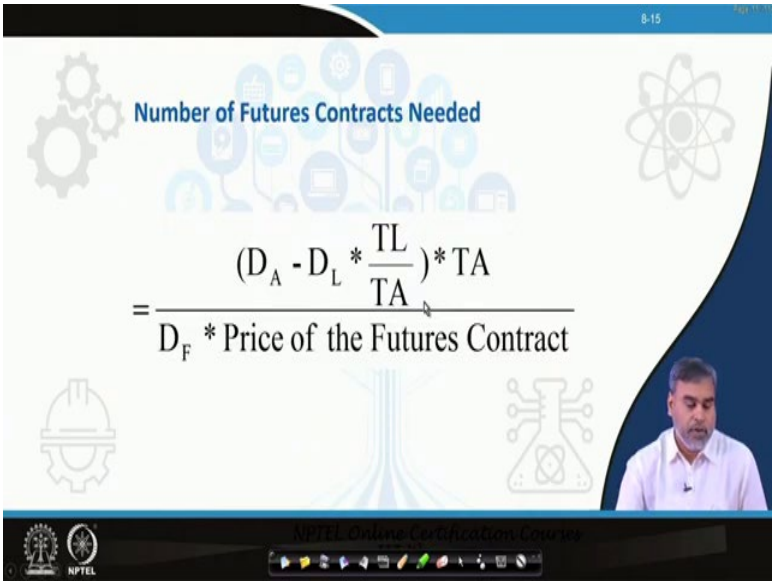


So, if you are going to find out the change in the market value of the future contract then any positive or negative change in the future positions value basically if you want to calculate, this is nothing but the minus of the duration of the underlying security named in the future contract multiplied by the initial future price multiplied by the number of the future contracts multiplied by the change expected in the interest rate divided by 1 plus original interest rate.

That means your F_t is the future value of that particular contract at time t. F_0 is the future value of the particular contract which is originally or the initial price is nothing but the minus of the duration multiplied by the F_0, F is the initial future prices of that particular contract, into N, N means the number of future contracts into $\Delta i/1 + i$.

So, this is the way we can find out that how the value of the future prices is going to be changed depending upon the durations and the change in the interest rates in the commercial banks.

(Refer Slide Time: 21:20)



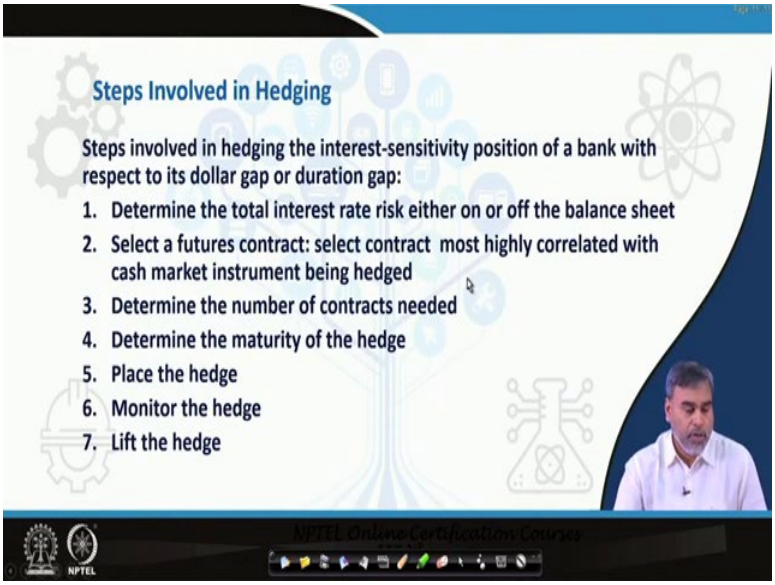
So, if you go by the, already we have seen that on the basis of the market value of the assets or the face value of the future contract we can calculate the number of contracts. You can also calculate the number of future contracts which are needed for hedging.

If you know the duration of assets and duration of liabilities of that commercial bank then it is nothing but your D A, duration of assets minus the duration of liabilities into total liabilities minus, divided by total assets into total assets, whole bracket into total assets divided by the duration of the future contract multiplied by the price of the future contract.

$$= \frac{(D_A - D_L * \frac{TL}{TA}) * TA}{D_F * \text{Price of the Futures Contract}}$$

So, if you know the duration of the future contract, you know the price of the future contract, you know the duration of underlying asset, duration of underlying liabilities, then you can calculate how many future contracts are needed to hedge the particular risk with this particular data. That also you can find out from there.

(Refer Slide Time: 22:28)

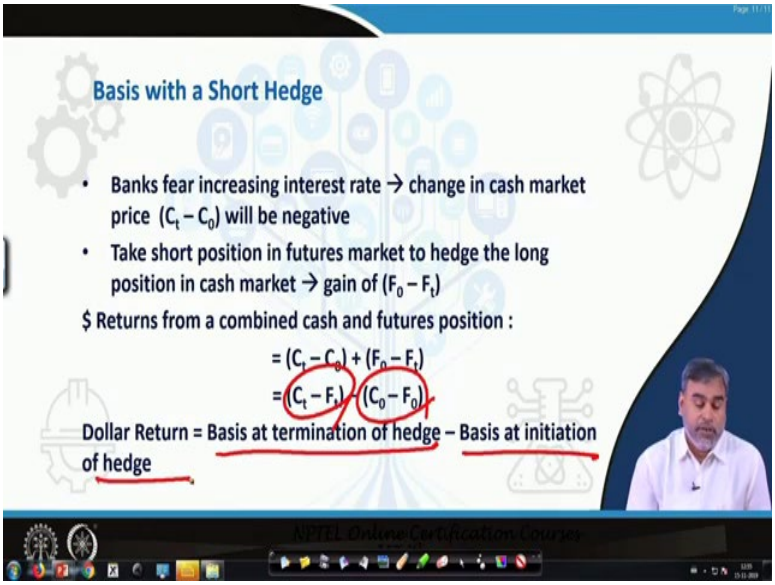


Then in terms of hedging if you talk about, there are different steps. The steps are basically like this with respect to the dollar gap and the duration gap. Determine the total interest rate risk on and off the balance sheet.

Select a future contract which is generally high, should be highly correlated with the cash market which is being hedged. Determine the number of contracts which are needed. Determine the maturity of the hedge. Place the hedge and regularly monitor the hedge whether hedge is really working or not and finally lift the hedge.

So, these are the regular process what the commercial banks or any financial institutions do if really they want to hedge the interest rate risk in the market or if there is a change in the interest rate risk, if they want to hedge the losses in the market then these are the steps what basically they have to follow.

(Refer Slide Time: 23:29)



Then we have the, already we know what is basis. The basis is nothing but the difference between the spot price and future price and in the end whenever the particular contract is matured the basis risk will be 0, or the basis will be 0. That means there will be no difference between the spot price and the future prices.

So, here if you talk about how the basis basically works for a short hedge and how the basis works for a long hedge, then for example if the bank's fear increasing interest rate, bank is thinking that interest rate is going to be increased with change in the cash market price then obviously today what is the price of that particular asset in the spot market, that will be changed.

So, C_0 will be the price of that particular asset today and C_t is the price of asset in the future then obviously $C_t - C_0$ will be negative because once the interest rate is increasing the value of the asset will go down. Then it will be, $C_t - C_0$, will be negative. So, in that particular point of time what basically we are doing?

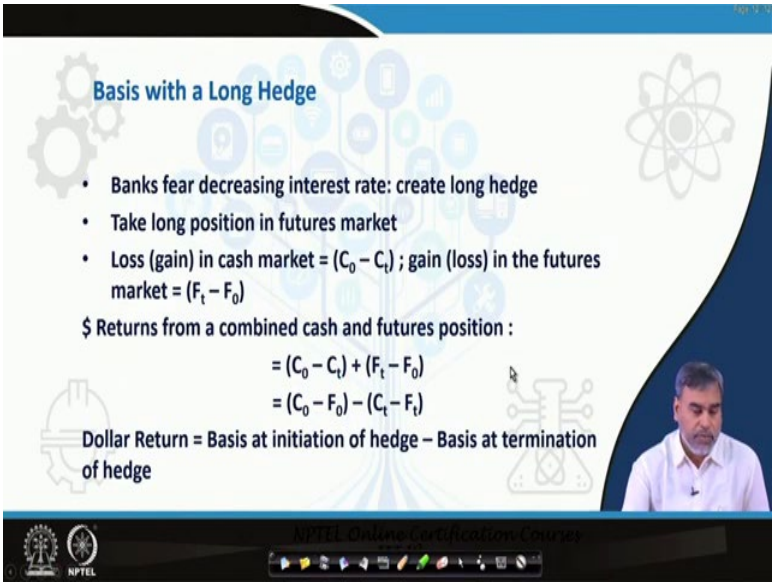
We are taking a short position in the future market to hedge the long position in the cash market. Then by that you can gain like your $F_0 - F_t$. F_0 is the original future price and F_t is the price which is going to prevail because the market price is going to be down.

So, then how much return basically you can extract from this? The return basically you can extract, that is nothing but your $C_t - C_0$ which is already negative and plus $F_0 - F_t$ which will be positive. So, it is nothing but your $C_t - F_t$, your spot price for today minus the future price at the time t-C_0 - F_0, C_0 is the original spot price and F_0 is the original future price.

So, now what basically we call it that the total dollar return what basically we are going to get, if there is a change in the interest rate and accordingly the value of the particular asset is going to be changed. This is the way basically the dollar return can be calculated. So, the dollar return is equal to basis or termination of the hedge which is nothing but the C_t-F_t. This is basically the basis calculation; C_t -F_t is the basis at the termination of hedge; and C_0 - F_0 which is the basis at the initiation of the hedge.

So, that is basically the return what you can generate whenever you have change in interest rates in the market and you have the different future prices and different spot prices exist in that particular time.

(Refer Slide Time: 26:30)



Then if you see basis with a long hedge then how basically it works? Then if the bank is expecting that there is a decrease in the interest rate then they want to go for a long hedge. So, they take a long position in the future market, that already we have explained. Take a long position in the future market. Whatever loss or gain they get in the cash market, basically C_0 - C_t, and the gain or loss in the future market will be F_t - F_0.

So, the dollar return will be what they will be getting, (C_0 -C_t)+(F_t -F_0.) Then finally it will be (C_0 - F_0)-(C_t -F_t.) So, again the dollar return is the basis at initiation of the hedge minus the basis at the termination of the hedge.

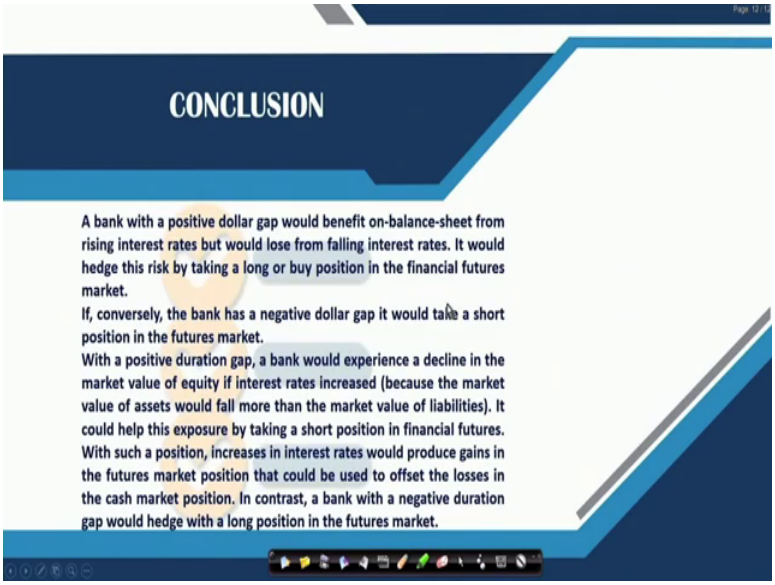
So, the difference between these two, the previous one is the basis at the termination of the hedge minus the basis at the termination, initiation of the hedge. Here the basis at the initiation of the hedge minus the basis at the termination of hedge. So, this is for the long

hedge, the other one is the short hedge. That is the basic difference between the long hedge and short hedge position in the system.

(Refer Slide Time: 27:44)

So, if you want to summarize it this is the way it works. So, the realized return from combining cash and future market trading can be return earned in the cash market plus or minus profit or loss from the future trading minus the closing basis between the cash and future markets minus the opening basis between cash and the future markets, so that is what basically we have explained in the previous sessions.

(Refer Slide Time: 28:14)



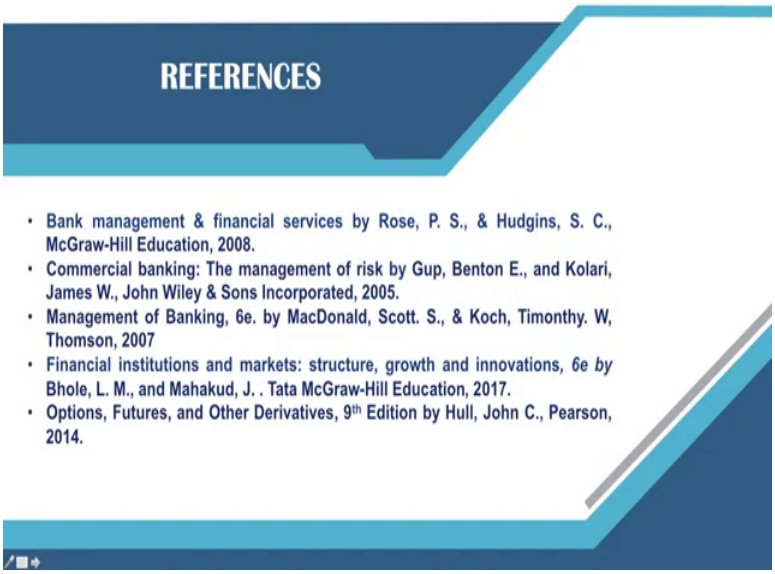
So, coming back to the conclusion what basically we have received that the bank with the positive dollar gap always get the benefits whenever the interest rate will rise but if there is a possibility of decline in the interest rate then it should hedge the risk by taking a long positions in the financial futures market. So, if the bank already has a negative dollar gap then they can go for short position in the future market or they can take the help of the short hedging.

So, the same logic if you apply for the duration gap, so if the duration gap is positive then if the interest rate is increasing then obviously the particular bank is going to lose in the spot market. So, because of that they want to use this short hedging positions, take the help of the short hedging positions. If the interest rate is going to decline then they can take the help of a long hedge position in that particular point of time.

So, the positive duration gap, the bank would experience the decline in the market value of equity if interest rate increased then it would help this exposure by taking a short position in the financial futures, and again if the bank with the negative duration gap would hedge with a long position in the future market.

So, again we have also role of the basis risk then already you know that the basis risk will be 0 whenever the contract will be matured and the dollar return what you can expect from this, that is difference between the basis at the initiation stage and the basis at the termination stage. So, this is the way the dollar return from the trading can be achieved whenever you have positions for both spot markets and the future markets.

(Refer Slide Time: 30:14)



So, these are the references what you can go through for the detailed analysis and the other sessions like use of options, swaps and all these things we will be discussing in the future sessions, thank you.