Management of Fixed Income Securities
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Lecture - 60
Fixed Income Securities Derivatives - V

Welcome back. So, in the previous class we discussed about the swap mostly the interested swap and how these particular swaps are evaluated and how these are useful for the investors to change their nature of assets and nature of liabilities and as well as also they can be used for the speculative and the hedging purposes.

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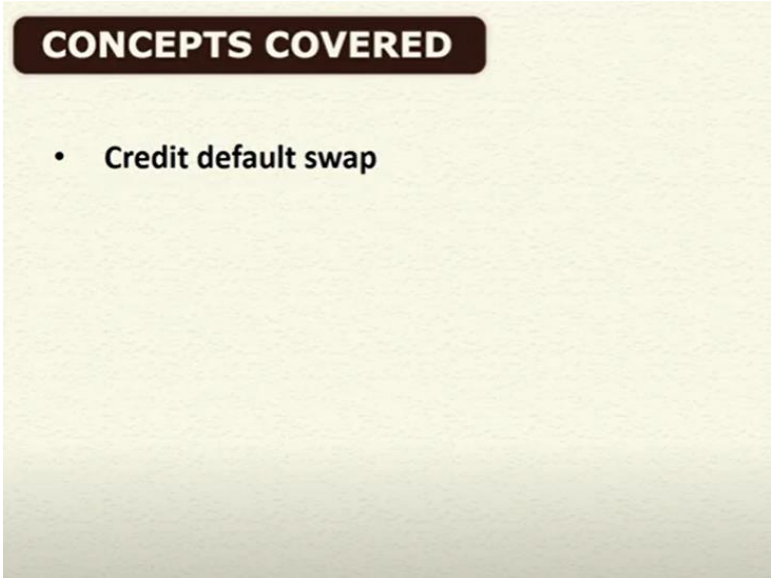

We will be discussing about another type of instrument, which is based upon again the fixed income market that is called the credit default swap. So, today mostly our discussion will be largely covered up on the particular issue that is called the credit default swap.

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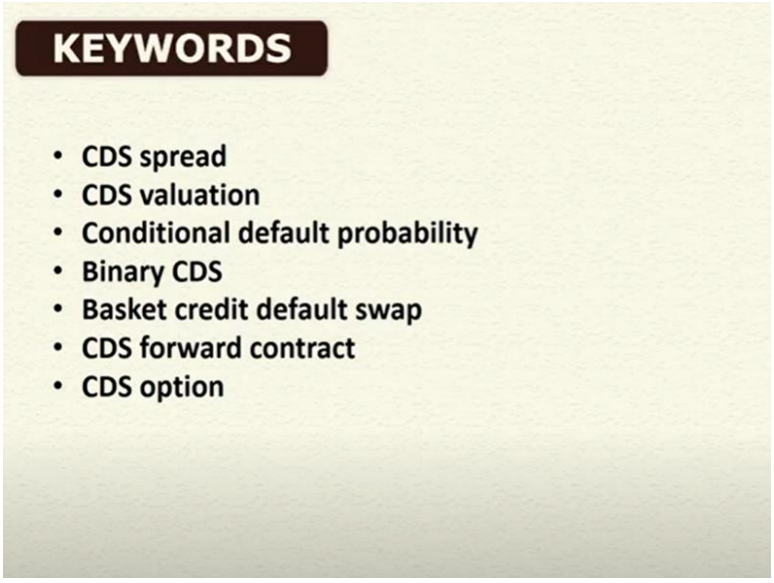

So, here there are certain keywords you will come across like your credit default swap spread, credit defaults or valuation, conditional default probability, binary credit default swap, basket credit default swap, credit defaults of forward contract, credit defaults of option and all these things.

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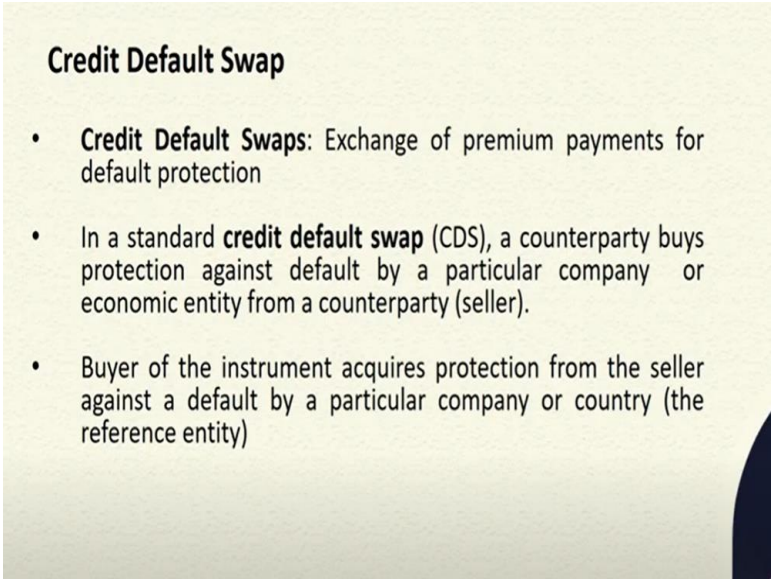

So, let us see that what exactly the credit default swap is. The credit default swap is basically a kind of instrument where the exchange of premium payments for the default protection. So, this is used basically for the default protection mostly it takes care of the default risk. So, in a standard credit default swap, a counter party basically buys the protection against the default by particular company or economic entity from a counterparty.

So, buyer of the instrument generally acquires the protection from the seller against a default by a particular company or the country which is called the reference entity. So, here basically buyers acquire the protection from the seller against any kind of default.

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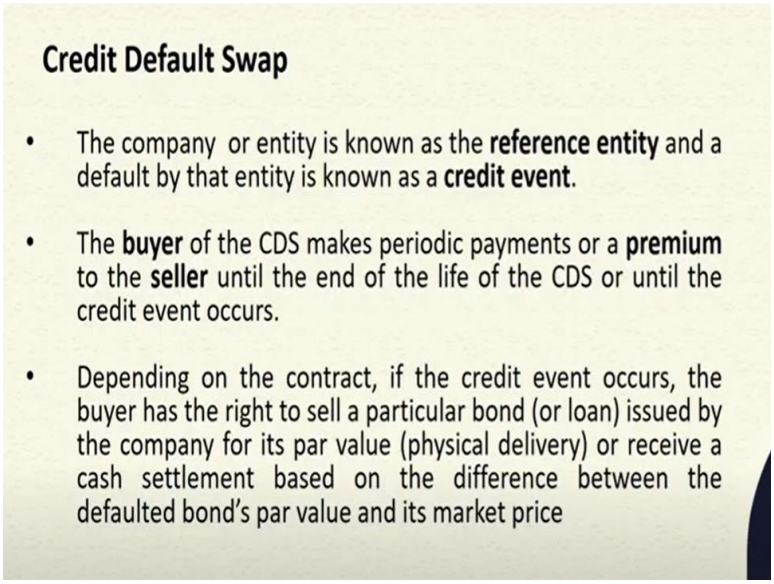

And the company or the entity generally is known as the reference entity and the default by that entity is known as the credit event. If there is any default then this kind of situation will arise then that time, we call it the credit event. So, the buyer of the credit default swap makes the periodic payments or a premium to the seller until the end of the life of the credit default swap or until the credit event occurs.

So, depending upon the contract, if the credit event occurs, the buyer has the right to sell a particular bond or loan issued by the company for its par value or receives a cash settlement based on the difference between the defaulted bond's par value and its market price. If the credit event occurs then this particular situation or this particular condition may arise. The buyer has the right to sell a particular bond issued by the company for its par value or receive a cash settlement based on the difference between the defaulted bond's par value and its market price.

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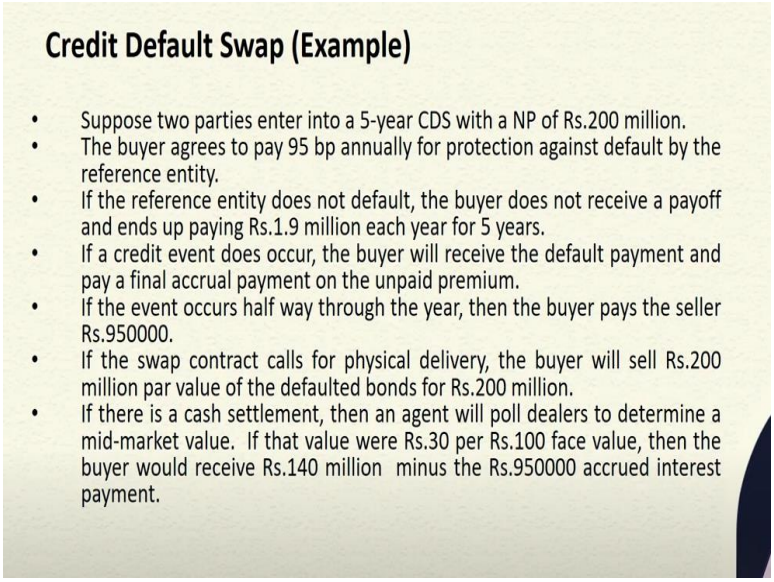

Now, if you take an example. Let us there are two parties enter into a five years credit default shop with a notional payment of 200 million. So, the buyer agrees to pay 95 basis points annually for protection against this default by the reference entity. So, if the reference entity does not default, then the buyer does not receive a payoff and end of paying around 1.9 million each year for the 5 years to 95 basis points annually against these notional payments.

For a credit event, if the credit event occurs, then the buyer will receive the default payment and pay a final accrual payment on the unpaid premium. So, if the event occurs half way through the year, then the buyer pays the seller 950000. If the swap contract calls for the physical delivery, then the buyer will sell 200 million par value of the defaulted bonds for the 200 million rupees. If there is a cash settlement, then an agent will pull the dealers to determine the mid-market value.

And if that value were let 30 rupees for 100 rupees face value, then the buyer would receive around 140 million minus the money whatever is considered as the accrued interest payment that they have already paid that is 950000. It is basically 950000. So, this is the way basically what the particular credit default swap concept works.

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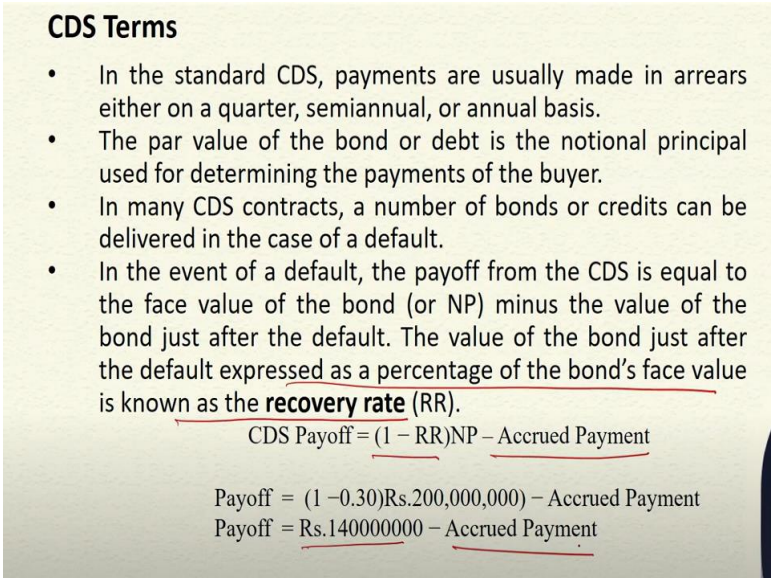

Then there are certain terms which are used while discussing about the credit default swap. In the standard grade default swap, payments are usually made in arrears either in quarter, semi-annual or annual basis. The par value of the bond or debt is the notional principal used for determining the payments of the buyer. So, in many serious contracts, the number of bonds or credits can be delivered in case of the default.

In case of default, the payoff from the credit default swap is generally equal to the face value of the bond minus the value of the bond just after the default. So, the value of the bond, if you look at the value of the bond, just after the default generally expressed as a percentage of the bonds face value. Generally, it is known as the recovery rate. So, your credit default of payoff is your 1 minus recovery rate into your notional principle or the face value of the bond minus your accrued payment.

So, in our example, if you look at, the payoff will be let 1- 0.3, which is the recovery rate into your 200 million minus accrued payment. That will be your one point or 140 million minus your accrued payment.

In our example, CDS pay off= (1-Recovery rate)NP or facevalue of bond – Accrued payments
Here, RR= 0.30

Face value of bond=200million

Accrued payments=?

Hence, Pay off = (1-0.30)200,000,000 – Accrued payments

Pay off = 140,000,000 - Accrued payments

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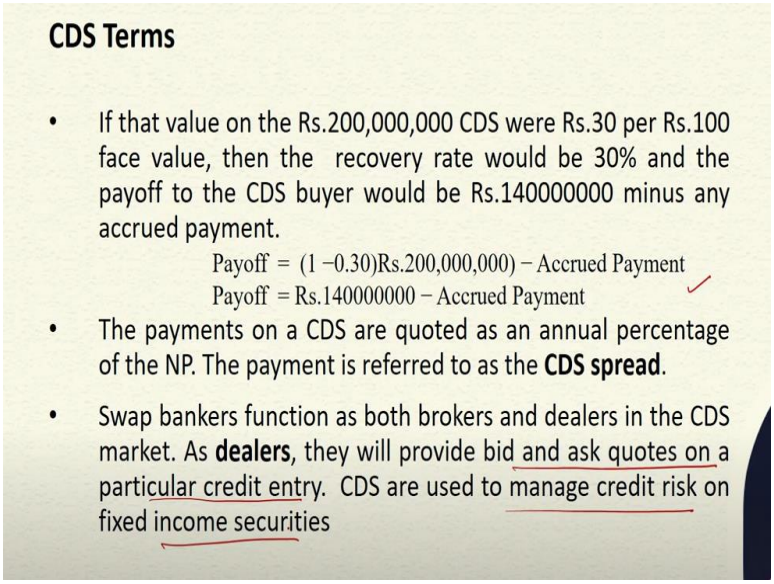

So, if that value on the 200 million CDS where already we have explained that. So, the payments on a CDS generally are quoted as an annual percentage of the notional principal. So, the payment is referred as the CDS spread. So, this is basically what we have tried to see here again from this we have represented it here. So, the payments on a CDS generally are quoted as an annual percentage of the notional payment and the payment is basically referred to as the CDS spread.

So, the swap bankers generally function as both brokers and dealers in the CDS market as dealers they will provide bid and ask quotes on a particular credit entity and the CDS are used to manage the credit risk on the fixed income securities. So, the same calculation we have reported here for the better understanding. So, this is the way basically the CDS are used. The credit default swaps are basically used to manage the credit risk on the fixed income securities.

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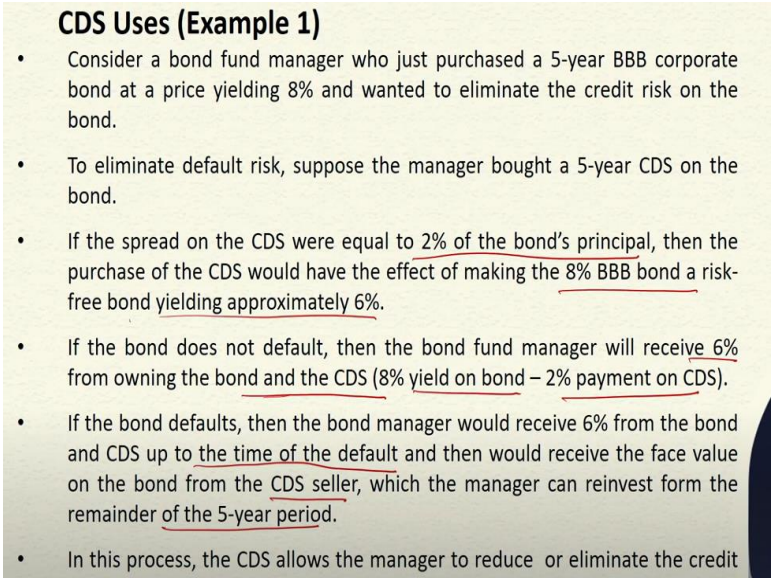

Let us see how the credit default swaps are used. Let us take an example, consider a bond fund manager who just purchased a 5 year BBB corporate bond at a price which is yielding 8% and that particular manager wanted to eliminate the credit risk on the bond. So, to eliminate the credit risk what the bond manager has done, he has basically bought a 5 year credit default swap on the bond. So, if the spread on the CDS = 2% of the bonds principal, let we have taken 2% of the bonds principal.

Then the purchase of the CDS would have the effect of making the 8% BBB bond on a risk free bond yielding approximately 6%, because this spread is 2%. If the bond does not default, then the fund manager will receive 6% from owning the bond and the CDS. That is the 8% yield on a bond minus 2% payment on the CDS.

The fund manager will receive = (8% yield on bond – 2% payment on CDs) = 6%

If the bond defaults then the bond manager would receive 6% from the bond and CDS up to time of the default. He would receive the face value on the bond from the CDS seller which the manager can reinvest from the remainder of the 5 years period. So, in this process what will happen? The credit default swap allows the manager to eliminate the credit risk on the bond. So, this is the credit risk on the bond, you can see that one.

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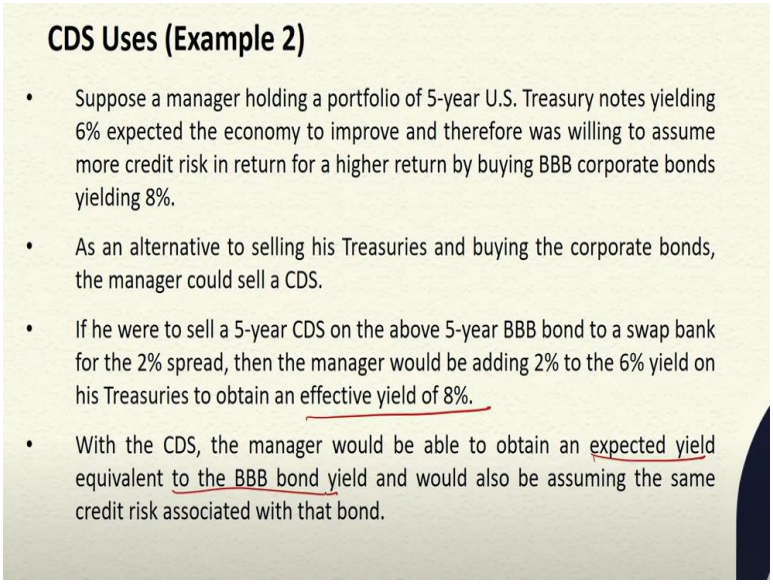

So, another one is basically if you see, if you look at the other uses; suppose a manager is holding a portfolio of the 5 years treasury nodes, U.S treasury nodes, yielding the 6% expected the economy to improve and therefore was willing to assume more credit risk in return for a higher return by buying the BBB corporate bonds yielding 8%. Then what they can do? They can alternative to selling the treasuries and buying the corporate bonds the manager could sell the credit default swap.

So, if you are to sell a 5 year credit default swap on the above 5 year BBB bond to a swap bank for the 2% spread. Then what will happen? The manager would be adding 2% to the 6% yield on his treasuries to obtain the effective yield of 8%. So, with the CDS the manager would be able to obtain an expected yield equivalent to the BBB bond yield would also be assuming the same credit risk associated with that particular bond.

That depends upon the market expectations they can also always use the credit default swap to hedge their risk or to manage the risk.

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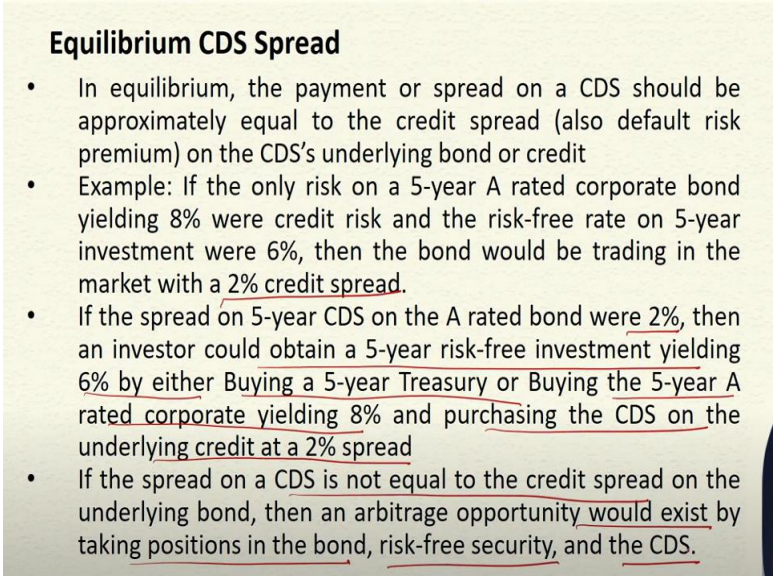

So, then what is the equilibrium CDS spread? In equilibrium the payment or spread on a CDS should be approximately equal to the credit spread or we can say the default risk premium on the CDS underlying bond or the credit. For example, if the only risk on a 5 year A rated corporate bond yielding 8% were credit risk then the risk free rate on a 5 year investment was 6%, then the bond would be trading in the market with a 2% credit spread.

If the spread on a 5 year CDS on A rated bond were 2%, then the investor could obtain a 5 year risk-free investment which is yielding 6% by either buying a 5 year treasury or buying the 5 year A rated corporate yielding 8% and purchasing the CDS on the underlying credit at a 2% spread both are same. So, if the spreads on a CDS is not equal to the credit spread on the underlying bond, then an arbitrage opportunity would exist by taking the position in the bond, risk-free security and the credit default swap.

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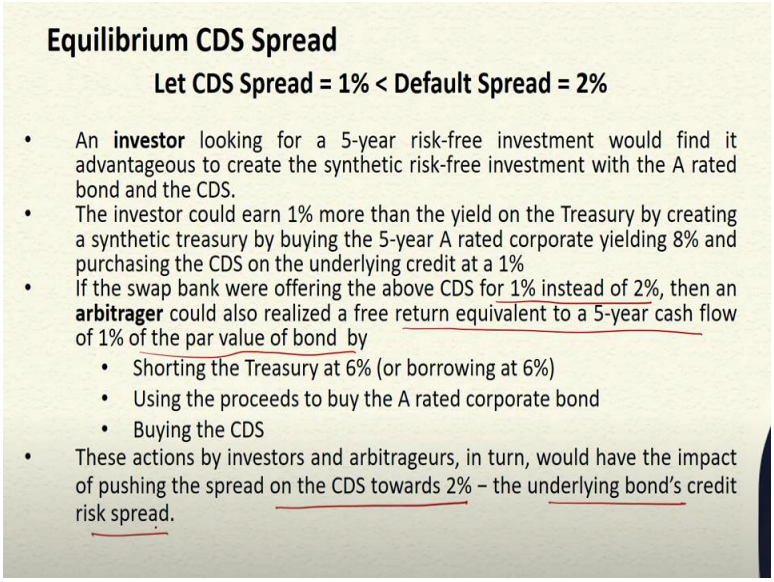

Let, CDS spread =1%<Default spread=2%

So, let the CDS spread is 1%, which is less than the default spread of 2%. So, then what will happen? The investor looking for a 5 years risk-free investment would find it advantageous to create the synthetic risk-free investment with the A rated bond and the CDS. Then what will happen? The investor could earn 1% more than the yield on the treasury, by creating a synthetic treasury by buying the 5 year A rated corporate yield, corporate bond, which is yielding 8%. And purchasing the CDS on the underlying credit at a 1%. So, if the swap bank were offering the above CDS for 1% instead of 2%, then an arbitrager could also realize a free return equivalent to a 5 year cash flow of 1% of the par value of the bond.

How they can create? 1. By sorting the treasury at 6% or borrowing at 6%. 2. Use that particular proceeds to buy the A rated corporate one and 3. Buy the CDS.

These actions generally by the investors or the arbitrators, would have the impact of purchasing the or may be pushing the spread on the credit default swap towards 8% and the underlying bonds credit risk spread basically, will be equal to that. So, then the equilibrium can be achieved in that particular context.

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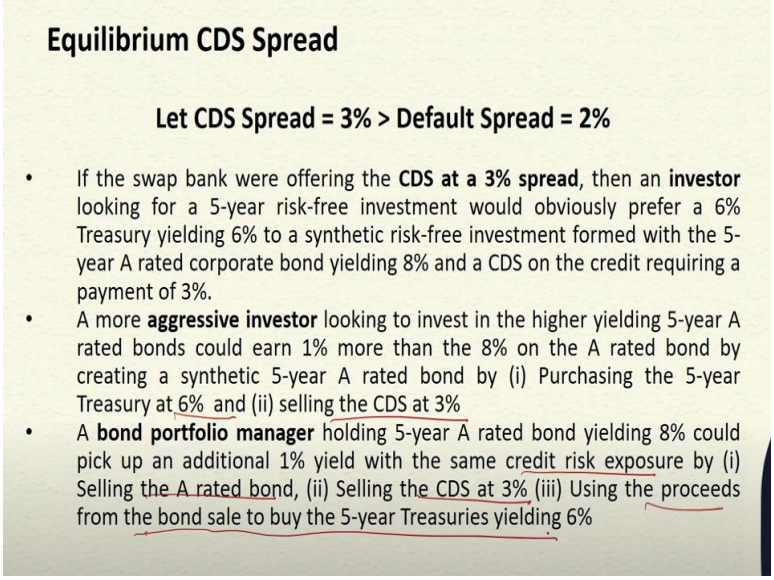

Let, CDS spread =3%<Default spread=2%

So, let this spread is 3% CDS spread is 3%, which is more than the default spread of 2%. So, then the if the swap bank are offering the CDS at 3% spread, then the investor looking for a 5 years risk-free investment would obviously prefer a 6% treasury yielding 6% to a synthetic risk-free investment formed with the 5 year A rated corporate bond, which is yielding 8% and the credit default swap on a credit rating or credit requiring a payment of the 3%.

Then, a more aggressive investor looking to invest in higher yielding 5 year A rated bonds could earn 1% more than the 8% on the A rated bond by creating the synthetic 5 year A rated bond by purchasing the 5 year treasury at 6% and selling the CDS are 3%. A bond portfolio manager holding the 5 year A rated bond yielding 8% could also pick up an additional 1% yield with the same credit risk exposure by selling the A rated bond, selling the CDS at 3%, using the proceeds from the bond sale to buy the 5 year treasuries which is yielding 6%.

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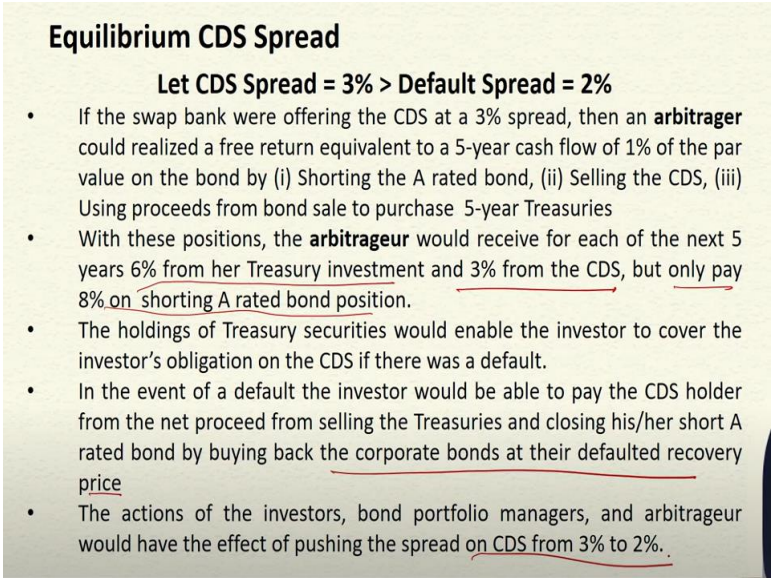

So, in this case if the swap banks are offering the CDS at 3% spread, then the arbitrager could realize a free return which is equivalent to the 5 years cash flow of 1% of the par value of the bond. How they can achieve it? By sorting the A rated bond, selling the CDS and using that process from the bond sale to purchase the 5 year treasuries. With these options, the arbitrageur could receive for each of the next 5 years 6% from our treasury investment and 3% from the CDS but only pay 8% on shorting the A rated bond positions.

So, the holding of the treasury securities would enable the investor to cover the investor's obligation on the CDS if there were a default. In the event of a default, then what will happen? The investor would be able to pay the CDS holder from the net proceeds from selling the treasuries and closing his or her short A rated bond by buying back the corporate bonds at their defaulted recovery price.

So, the actions of the investors, bond portfolio managers and arbitragers would have the effect of pushing the spread on CDS from 3% to 2%. That equilibrium can be achieved which will be equal to the default spread which is prevailing in the market.

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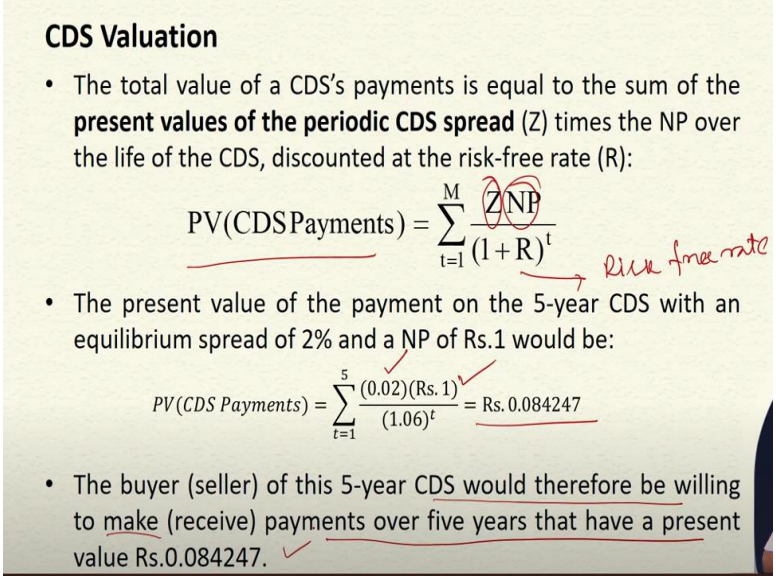

So, then how this credit default swaps are valuated? How the valuation is done? So, the total value of the CDS payments is generally equal to the sum of the present value of the periodic CDS spread. That we are representing at Z times the in notional principal over the life of the CDS, discounted at a risk-free rate. So, if you are trying to calculate the present value of the CDS payment, that is let M is the total period. Maturity t = 1 to M. Summation t = 1 to M, Z into NP.

Present value of CDS payments= $\sum_{t=1}^{M} \frac{Z.NP}{(1+R)^t}$

Z is the periodic CDS spread and NP is the notional principal and R is basically your risk-free rate. This is your risk-free rate.

So then if you say this example, at the present value of the payment of a 5 year CDS with equilibrium spread of 2%. Let a notional principle of rupees 1, then that will be t, summation t = 1 to 5, 0.02 is the Z value or the periodic CDS spread, 1 rupees is the notional principle, 1.06 to the power t. That will give you this much 0.084247.

Present value of CDS payments= $\sum_{t=1}^{M} \frac{Z.NP}{(1+R)^t}$

Present value of CDS payments = $\sum_{t=1}^{5} \frac{(0.02)(Rs.1)}{(1+0.06)^5} = 0.084247$

So, the buyer or seller of this 5 year CDS would therefore be willing to make or receive payments over 5 years that have a present value of 0.084247. So, that is the way the valuation of the particular CDS is done.

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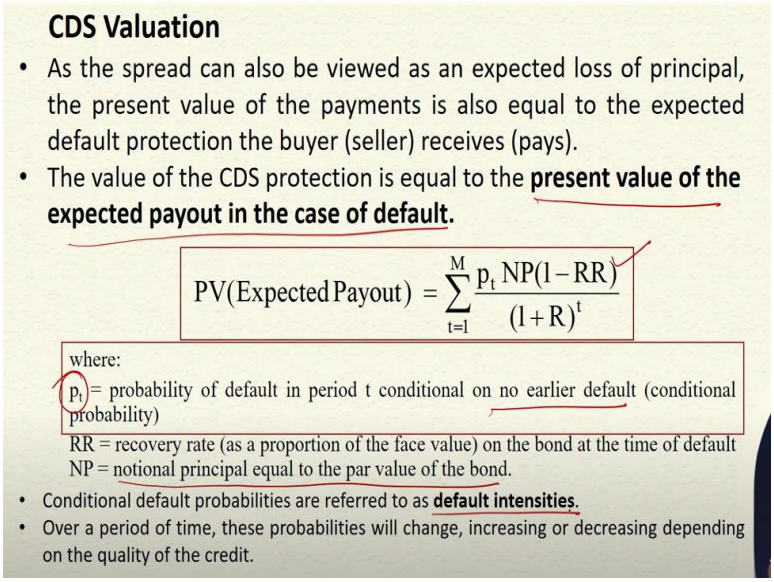

So, as this spread can be viewed as a expected loss of the principal, the present value of the payment is also equal to the expected default protection the buyer receives or the seller pays. So, the value of the CDS protection is also equal to the present value of the expected pay-out in the case of default. So, that means, the present value of expected pay-out will be your again summation t = 1 to M, P t into NP into 1 - RR divided by 1+R to the power t.

PV(expected payout)= $\sum_{t=1}^{M} \frac{P_t \, . \, NP(1-RR)}{(1+R)^t}$

Here your Pt is basically Probability of default in period t conditional on no earlier default. And RR is basically your recovery rate on the bond or the time of the default which is a proportion of the face value and your NP is basically the notional principal equal to the par value of the bond. Here the conditional probability concept is very important. The Pt is basically you have to find out. The probability of default in period t is conditional on no earlier default.

So, that is why it is a conditional probability. So, the conditional different probabilities are generally referred as the default intensity. These are basically called as the default intensity. So, over a period of time, these probabilities will change, increasing or decreasing depending on the quality of the credit. If the quality of credit is better, then this the particular thing will change differently.

If it is not good or it is basically worse, then in that case also that will basically change this conditional probability. So, that is another way the credit default swap valuation also can be done.

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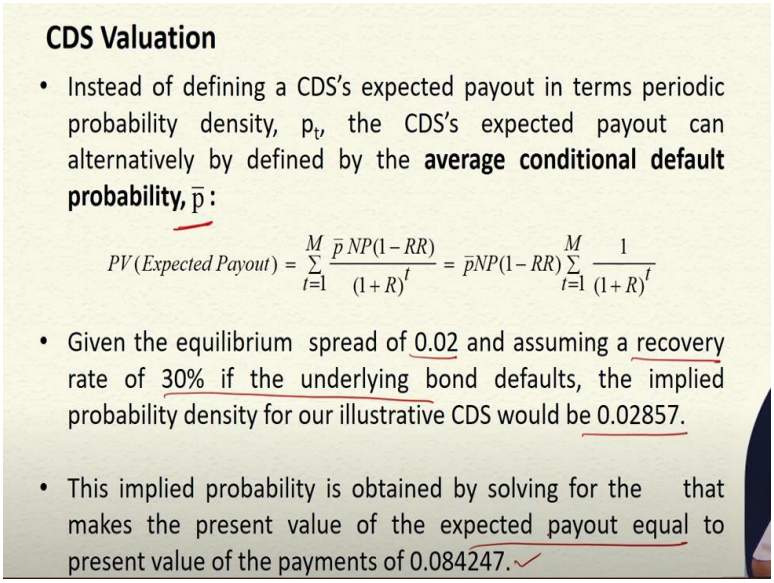

So, instead of defining the CDS's expected pay-out in terms of the periodic probability density, that is Pt the CDS's expected pay-out can alternatively also defined by the average conditional different probability that p bar so this is your p bar, which is the average conditional default probability. So, how this can be calculated, that is summation t = 1 to M same thing p bar into NP into 1- RR divided by 1+R to the power t which is nothing but the if you take this side p bar. And p into 1-RR, then it will be summation t = 1 to M 1 by 1+R to the power t.

Hence, Present values of expected probability will be:

$$\sum_{t=1}^{M} \frac{\ddot{P}.\ NP(1-RR)}{(1+R)^t} = \ddot{p}.\ \text{NP(1-RR)}\sum_{t=1}^{M} \frac{1}{(1+R)^t}$$

So, given the equilibrium spread of 0.02 or 2% and assuming a recovery rate of 30% if the underlying bond defaults, then the implied probability density for our; example or illustrative CDS, whatever we have taken before would be 0.02857. So, this implied probability is obtained by solving for that makes the present value of the expected pay-out equal to the present value of the payments of 0.084247 that already what we have calculated.

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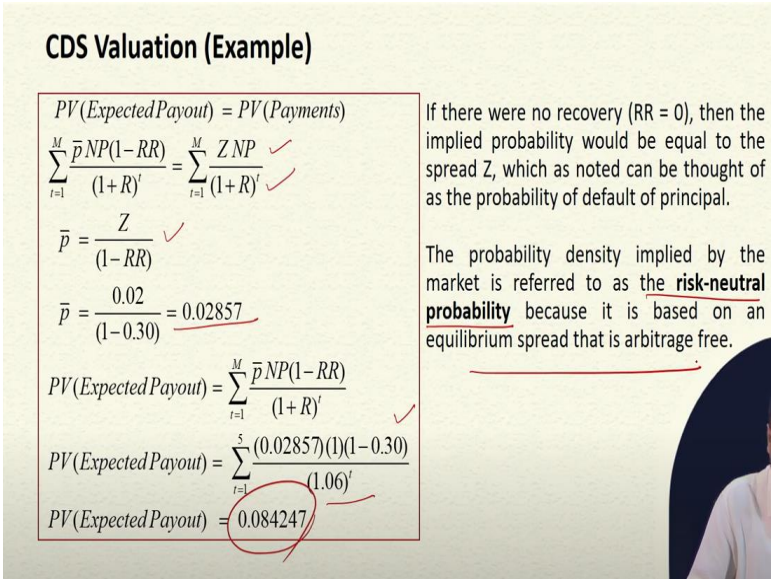

Let us see how it has been derived. Your present value of expected pay-out is nothing but the present value of the payments. That means your p bar summation t = 1 to M, p bar NP, 1 - RR, 1+R to the power t is equal to t = 1 to M, Z NP 1+R to the power t, then p bar is nothing but Z by 1-RR, then p bar = your 0.02 divided by 1-0.3, then you will find 0.02857, then your present value of the expected pay-out will be 0.02857 into 1 and 1-0.3 divided by 1.06 to the power t.

And here you have to take the summation t = 1 to 5, then obviously you will also find 0.0842%.

We know, present value of expected pay-out = present value of payments

So, $\sum_{t=1}^{M} \frac{\ddot{P}.\ NP(1-RR)}{(1+R)^t} = \sum_{t=1}^{M} \frac{Z\ .\ NP}{(1+R)^t}$

Here, $\ddot{P} = \frac{Z}{(1+RR)}$

$\ddot{P} = \frac{0.02}{(1-0.30)} = 0.02857$

Hence, PV of expected pay-out = $\sum_{t=1}^{M} \frac{\ddot{P}.\ NP(1-RR)}{(1+R)^t}$

$= \sum_{t=1}^{5} \frac{0.02857.\ 1\ (1-0.30)}{(1+0.06)^5}$

$= 0.084247$

Hence, present value of expected pay-out is 0.084247.

So, if there were no recovery let RR = 0, then the implied probability would be equal to the spread that is Z which is can be thought of the probability of default of the principal. And the probability density implied by the market generally referred to as the risk-neutral probability. It is called the risk-neutral probability, because it is based on an equilibrium spread that is basically arbitrage free. That is the way the valuation of the credit default swap is always done.

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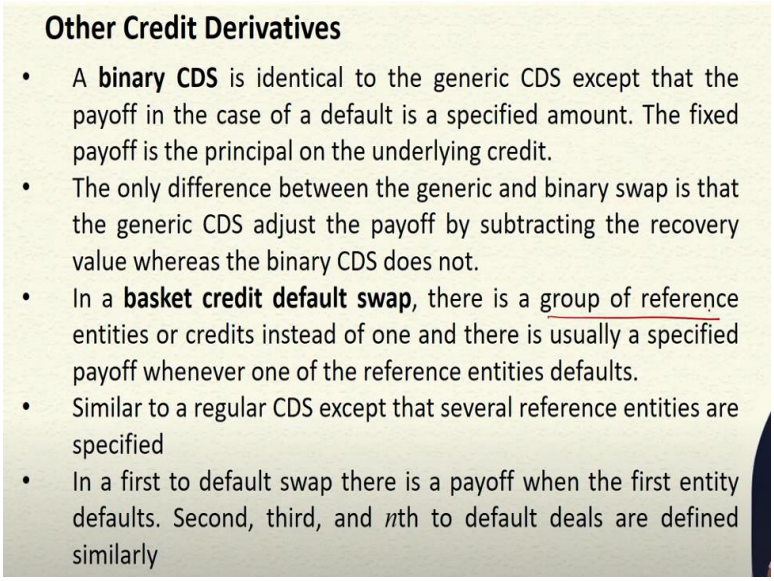

There are some other credit derivatives also we see. One is your binary CDS, like your binary credit default swap. This is again identical to CDS whatever just now we have discussed, except that the payoff in case of default is a specific amount. The fixed payoff is the principal on the underlying credit. The generic CDS adjust the payoff by subtracting the recovery value, whereas the binary CDS does not. That is the basic difference between these two.

And there is another CDS we have that basket credit defaults swap. So, there is a group of reference entities or credits instead of one and there is usually a specified payoff whenever one of the reference entities defaults. So, similar to the regular CDS except that several reference entities are specified. So, in a fast to default swap there is a payoff when first entity defaults. Second, third and nth to default deals are defined similarly.

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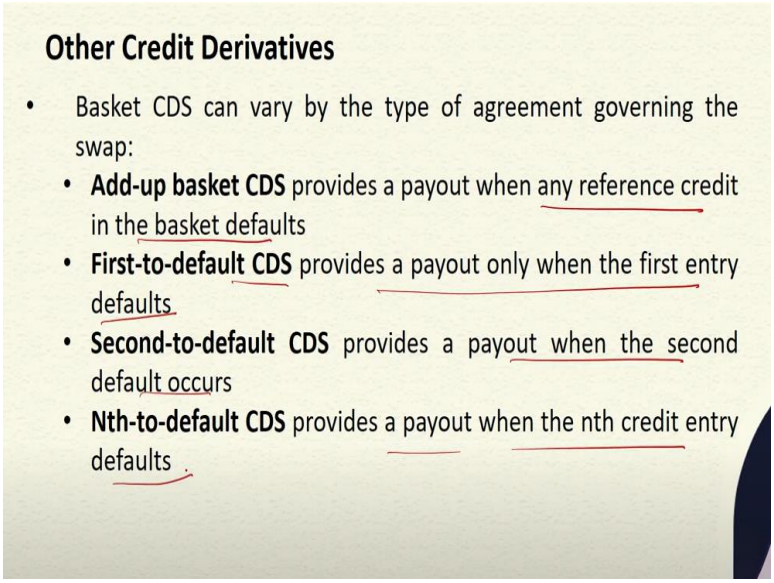

So, if you look at, the basket default swaps can vary by the type of agreement, which is governing on the swap. You can have add-up basket CDS. It provides the pay-out when any reference credit in the basket defaults. Then first-to-default CDS it provides a pay-out only when the first entity defaults or fast entry defaults. Then second-to-default provides a pay-out when the second default occurs.

And Nth-to-default provides a pay-out when the nth credit in entry basically defaults. So, these are basically the different kind of type of agreement which can be available with respect to the basket credit default swap.

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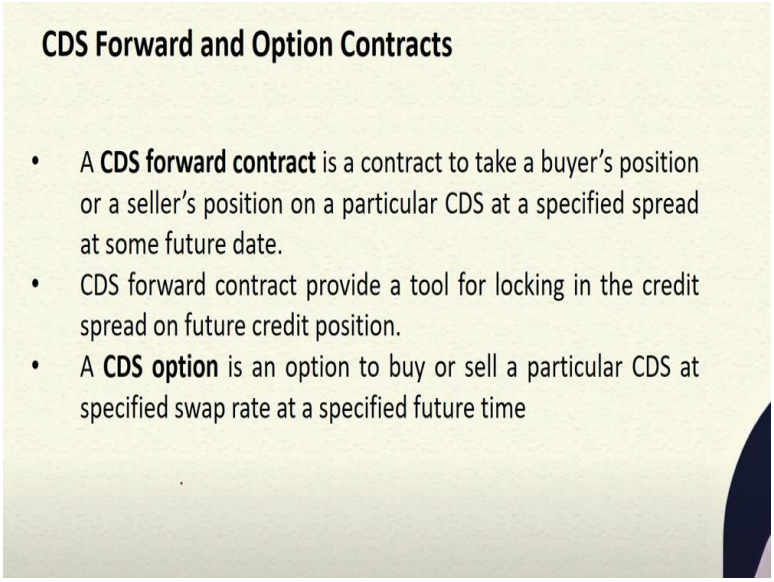

Then we have CDS forward contract. It is basically a contract to take a buyer's position or a seller's position on a particular credit default swap at a specified spread at some future date. And the CDS forward contract basically provide a tool for locking in the credit spread on future credit positions. So, whatever way it is the forward contracts are used, the same way the credit default software contracts also used for locking the credit spread on the future credit positions.

We can also have the credit defaults of option. So, this is basically an option to buy or sell a particular credit default swap or specified swap rate at a specified future time. So, that is basically the option can be also created on the credit default on. So, that is the option to buy or sell a particular CDS at a specified swap rate at a specified future time period. So, these are the other type of credit default swaps derivatives as a derivatives instrument also available in the market for the investor to get rid of any kind of default test.

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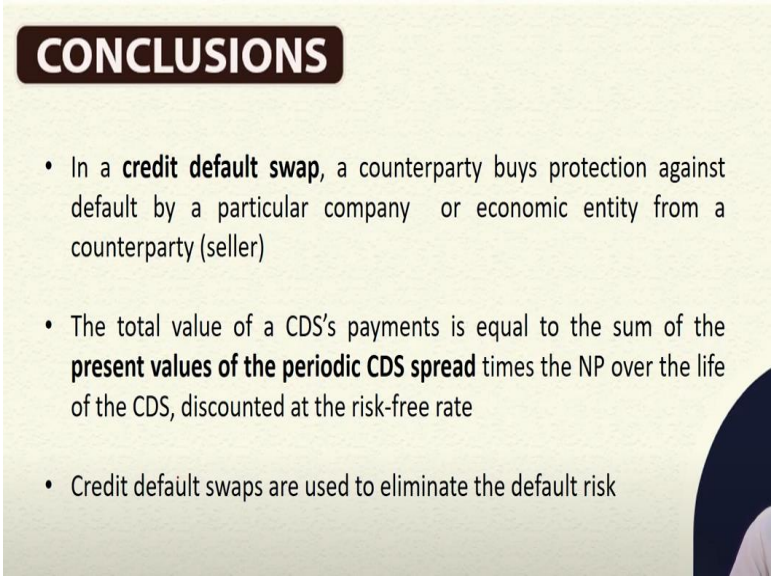

So, what basically we have discussed that in a credit default swap, a counter party buys the protection against the default by a particular company or economic entity from a counter party or the seller. And there is different type of credit default swaps always we come across on the basis of the agreements, which is governing against that. And the total value of CDS payments is equal to the sum of the present value of the periodic CDS spread times the notional principal over the life of the credit default swap which can be discounted at a risk-free rate. And the basic use of the credit default swaps is generally used to eliminate the default risk. So, these are the different kind of uses what we can say. But mostly the credit default swaps are used to eliminate or to manage the default risk of this particular contract. So, these are basically the things which are related to the credit default swap.

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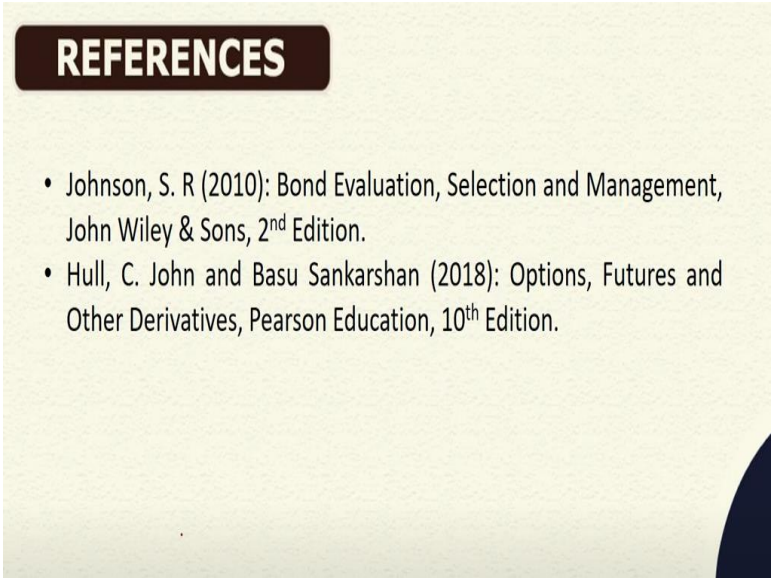

And these are the different references you can go through for the credit default swap.

Concluding the session

So, here we are closing this particular discussion with respect to the credit default swap and also the all the discussions related to the fixed income securities or management of fixed income securities. Hope you will have a broad idea about the all those kinds of instruments which are related to the fixed income securities and how those instruments are defined and how these instruments are used by the investor to manage the risk mostly how to hedge the risk and how these instruments can be also utilized for the speculative purposes. So, this is the broad objective of this particular subject and hopefully you will have a comprehensive idea about the various instruments which are traded in this particular market and also how these instruments are utilized to manage the risk.

And how the also the portfolios can be constructed using the different strategy to manage the risk like interested risk or the liquidity risk or the credit risk all type of measure is what general we face in the market. So, from here we can stop the discussion with respect to this particular subject hope for you must have gained a fair idea about the different type of fixed income securities what generally we come across while investing in the bond markets and as well as other fixed income securities market. So, this is the reference for the today's class.

Thank you.