Management of Fixed Income Securities
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Lecture - 54
Mortgage Backed Securities - IV

Welcome back. So, in the previous class we discussed about or we started the discussion on the sequential way tranches and we will continue with that particular discussion today's session also.

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And while analysing this particular issue or while discussing that issue, we will come across certain specific types of tranches like accrual tranche, floating rate tranche, notional interest only class, planned amortization class, stripped mortgage-backed securities, non-agency residential mortgage-backed securities and so on.

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And we will come across certain keywords like concept of Z bond, the support bond, prime mortgage-backed securities, subprime mortgage bank securities, credit traunching, cash flow waterfalls, senior interest, subordinate interest and all these things.

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So, here if you see that we have started the discussion on the sequential pay tranches. And there are certain tranches are specific type of sequential pay CMOs. They can have an accrual bond class. So, this particular class is also called as the Z bond. What are the special characteristics of that Z bond? If there is a class of the bonds which is considered as the Z bond those bonds do not receive the current interest generally this interest payments are deferred.

They do not get the principal also they do not get interest also. So, the Z bonds current interest is used to pay down the principal on the other tranches. In the beginning whenever we have started the sequential pay tranches what we have seen that first tranche will get the principal and as well as interest. But unless the principal is not over the second tranche only will receive the interest but they will not receive any principal.

But in this case what will happen one of the tranches will not receive even interest also. So, in that case the principal amount for other tranches will increase. So, because of that it will increase their speed and reduce their average life of each tranche will go down. Suppose in our preceding example just now in the previous class whatever we have taken we make the tranche C on accrual tranche A, B, C we have considered 50, 30, 20 million each.

Then here if you assume that the tranche C on accrual tranche in which is interest of 7.5% is to pay to the earlier tranches and its principle of 20 million and accrued interest to be paid after tranche B principal has been retired. Then what will happen? The average life of the each tranche like A and B are going to be changed that means the tranche C will start getting both interest and principal earlier.

So, as the accrual tranches current interest is now used to pay down the other class principal the other tranches now have lower maturities and the average life. So, that is a typical type of tranche also sometimes we observe in the market.

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Floating-Rate Tranche

- CMO issuers often create **floating-rate** and **inverse floating-rate tranches**.
- The monthly coupon rate on the floating-rate tranche is usually set equal to a reference rate such as the London Interbank Offer Rate, LIBOR, while the rate on the inverse floating-rate tranche is determined by a formula that is inversely related to the reference rate.
- **Example:** Sequential-pay CMO with a floating and inverse floating tranches

Tranche	Par Value (Rs)	PT Rate
A	50 million	7.50%
FR	22.5 million	LIBOR + 50bp
IFR	7.5 million	28.3 − 3 LIBOR
Z	20 million	7.50%
Total	100	7.50%

- The CMO is identical to the preceding CMO, except that tranche B has been replaced with a floating-rate tranche, FR, and an inverse floating-rate tranche, IFR
- If the LIBOR is 8%, then the rate on the FR tranche is 8.5%, the IFR tranche's rate is 4.5%, and the WAC of the two tranches is 7.5%:

Then we have another type of tranche also possible that is called at the floating rate tranche or the inverse floating rate tranche. So, here what happens? The monthly coupon rate on the floating rate tranche is usually set equal to a reference rate like LIBOR, while the rate on the inverse floating rate tranche is determined by a formula that is inverse related to the reference rate. This inverse floating rate and floating rate that already we have discussed when we are discussing about the bonds.

Now if you take this example let the sequential pay CMO with a floating and inverse floating tranche. Let tranche A we have considered this is 50 million your pass-through rate is 7.5% then your tranche B whatever we have 30 million. Out of them 22.5 million is basically this floating rate tranche that is LIBOR plus 50 basis point then 7.5 million is basically the inverse floating rate tranche that is let we have considered 28.3 - 3 into LIBOR rate.

And we have taken another tranche is the Z bond that is your 20 million it is 7.5% then total is the 100 million. So, this CMO is identical to the preceding CMO except that the tranche B has been replaced with the floating rate tranche that is FR and the inverse floating rate tranche that is IFR. And if you assume that the LIBOR rate is let 8% let, then the rate on FR tranche will be 8.5% because it is LIBOR plus 50 basis point.

And the IFR tranche rate is 4.3% that means it is 28.3 - 3 into 8. And your 3 into LIBOR is 8% then it will be how much? 28.3 - 24 that mean it will be 4.3% and the WSE of the two tranches is 7.5%.

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Notional Interest-Only Class

- Many CMOs are structured with tranches that have different rates.
- When CMOs are formed this way, an additional tranche, known as a **notional interest-only (IO) class,** is created.
- The Notional interest-only tranche receives the excess interest on the other tranches' principals, with the excess rate being equal to the difference in the collateral's PT rate minus the tranches' PT rates.
- In our example: The notional IO class receives the excess interest on each tranche's remaining balance, with the excess rate based on the collateral rate of 7.5%.
- In the first month, for example, the IO class would receive interest of:

$$Interest = \left(\frac{0.075-0.06}{12}\right)Rs.50000000 + \left(\frac{0.075-0.065}{12}\right)Rs.30000000$$

$$Interest = Rs.62,500 + Rs.25000 = Rs.87500$$

Now let us see another type of tranche we have that is called the notional interest only class. So, many CMOs are structured with tranches that have the different rates. When the CMOs are formed this way an additional tranche which is known as the notional interest only class is created. The notional interest only tranche basically receives the excess interest on the other tranche principals with the excess rate being equal to the difference between the collaterals pass through rate minus the tranches pass through rate.

In our example, the notional IO class basically receives the excess interest on each tranches remaining balance and the excess rate based on the collateral rate of 7.5%. Let the first month the IO class would receive an interest of 0.075 - 0.06 divided by 12 into 50 million plus your 0.075 - 0.065 into 12 into 30 million let you got the interest of 87500 that is the extra interest what basically you can get.

$$\text{Interest} = (\frac{0.075-0.065}{12})Rs50000000 + \left(\frac{0.075-0.065}{12}\right) Rs30000000$$

Interest = Rs.62500+Rs.2500 = Rs.87500

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Notional Interest-Only Class

- In our example, A tranche's notional principal is the number of dollars that makes the return on the tranche's principal equal to 7.5%.

$$A's\ Notional\ principal = \frac{(Rs.50000000)(0.075-0.06)}{0.075} = Rs.10000000$$

$$B's\ Notional\ principal = \frac{Rs.30000000)(0.075-0.065)}{0.075} = Rs.4000000$$

$$Z's\ Notional\ principal = \frac{(Rs.20000000)(0.075-0.07)}{0.075} = Rs.1333333$$

Total Notional principal = Rs.15333333

Accordingly, your A's notional principal if you want to calculate, B's notional principal you want to calculate and Z's notional principal if you want to calculate then for each tranche if your notional principals are calculated then what will happen? In this case it is 10 million, this is 4 million, this is basically around 1.3 million. So, the total notional principal from this you will find that is basically your 15.3333 million.

So, that is basically another kind of tranche which can be created which is called basically the notional interest only class.
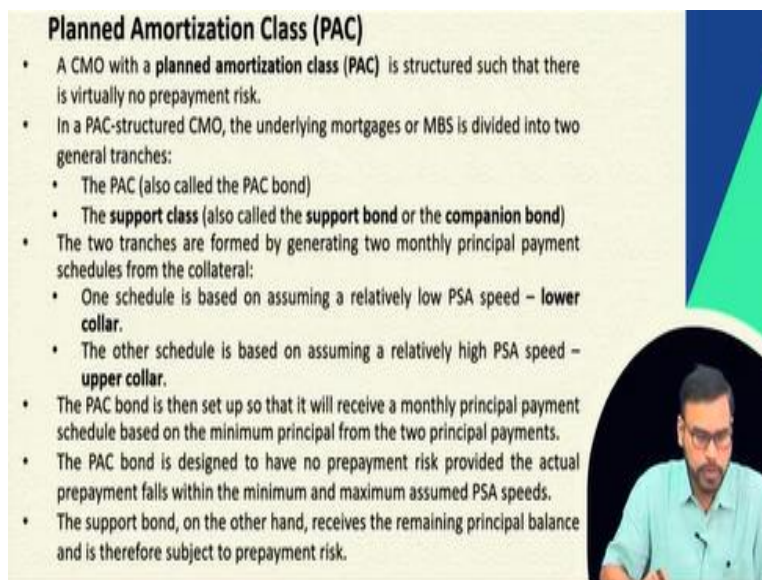
A's National principal $= \frac{(Rs.50000000)(0.075-0.06)}{0.075} = Rs.10000000$

B's National principal $= \frac{(Rs.30000000)(0.075-0.06)}{0.075} = Rs.40000000$

Z's National principal $= \frac{(Rs.20000000)(0.075-0.06)}{0.075} = Rs.1333333$

Total National principal = Rs.15333333.

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Planned Amortization Class (PAC)
- A CMO with a **planned amortization class (PAC)** is structured such that there is virtually no prepayment risk.
- In a PAC-structured CMO, the underlying mortgages or MBS is divided into two general tranches:
  - The PAC (also called the PAC bond)
  - The **support class** (also called the **support bond** or the **companion bond**)
- The two tranches are formed by generating two monthly principal payment schedules from the collateral:
  - One schedule is based on assuming a relatively low PSA speed – **lower collar**.
  - The other schedule is based on assuming a relatively high PSA speed – **upper collar**.
- The PAC bond is then set up so that it will receive a monthly principal payment schedule based on the minimum principal from the two principal payments.
- The PAC bond is designed to have no prepayment risk provided the actual prepayment falls within the minimum and maximum assumed PSA speeds.
- The support bond, on the other hand, receives the remaining principal balance and is therefore subject to prepayment risk.
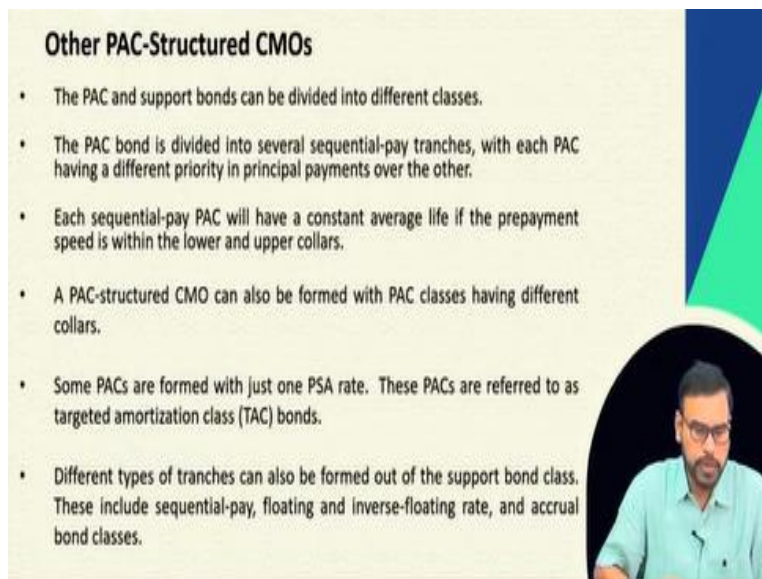
Then we have another type of CMO which is called the planned amortization class. In short, we call it the PAC.A CMO with a planned amortization class generally structured in such a way there are virtually no prepayment risk in this particular case. So, here what happens in a PAC particularly the planned amortization class structure the mortgage or the mortgage-backed securities is divided into two general tranches?

One is called the PAC bond and other one is basically what we call it the support class or we call it the support bond or the companion bond. How basically these two tranches are formed? The two tranches are basically formed by generating two monthly principal payment schedules from the collateral. So, one schedule is based on the assumption of a relatively low PSA speed that is called the low PSA speed means. It may be 50 or it may be 100 the other one it will be more than that 250 or the 300 that is called the lower collar.

And the other schedule is based on assuming a relatively high PSA speed that is called the upper collar. So, this plant amortization class bond is then set up in such a way so that it will receive a monthly principal payment which is scheduled based on the minimum principal from the two principal payments.

And the PAC bond is designed to have no prepayment risk provided the actual prepayment falls within the minimum or maximum assumed PSA speeds. And the other support bond whatever we are talking about that basically receives the remaining principal balance and therefore they are not subject to any prepayment risk in that particular context. So, that is basically called the planned amortization class.

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Let us see that what are the other PAC structured CMOs which are available. The PAC and the support bonds whatever just now we have seen they can be classified into the different classes. The PAC bond is divided into several sequential pay tranches each with PAC having a priority in principal payments over the other that we have seen in the sequential pay case. In the sequential plate tranche case basically, we are dividing these particular bonds on the basis of the characteristics. And we are making the different bond classes within that.

And each sequential pay PAC that means the PAC itself is divided into the different type of assets or different type of bonds or different classes are formed on that. So, each sequential pay PAC will have a constant average life if the prepayment speed is within the lower and upper
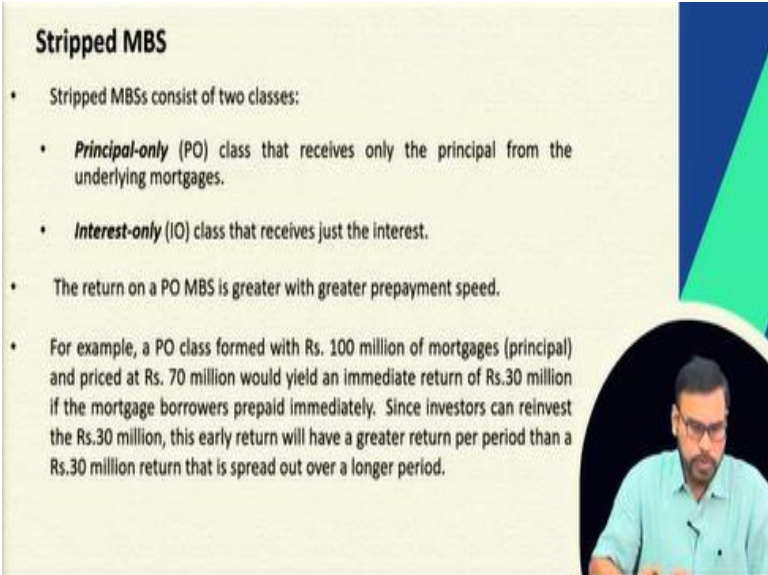
collars. If the prepayment speed is between the upper and lower collars then each sequential pay PAC will have a constant average life.

So, the PAC structured CMO can be also formed with a PAC classes having different collars. That means we can say that the prepayment rates can be changed or the model can be changed accordingly the different classes are different collars can be formed. And some PAC are formed with just one PSA rate and this PAC is generally referred as the targeted amortization class bonds. If one PSA rate is used and that is basically used to form this particular PACs then what will happen? These are called the targeted amortization class bonds.

And different types of tranches can also be formed out of the support bond class. These include sequential pay, floating, inverse floating and accrual bond classes that what we have discussed in the sequential pay process. So, here the PAC concept whatever we are talking about. There are two things what we have discussed one is PAC bond another one the support bond.

The PAC bond is again can be divided into different ways on the basis of the collars, on the basis of the prepayment speed; on the basis of the some sequential paid tranches all kinds of things can be possible. And again, the support class bond that also can be classified on the basis of the different tranches. On the basis of the floating and inverse floating rate, on the basis of accruals or on the basis of the other characteristics what we have discussed whenever we are discussing about the sequential pay process.

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Stripped MBS

- Stripped MBSs consist of two classes:

  - **Principal-only** (PO) class that receives only the principal from the underlying mortgages.

  - **Interest-only** (IO) class that receives just the interest.

- The return on a PO MBS is greater with greater prepayment speed.

- For example, a PO class formed with Rs. 100 million of mortgages (principal) and priced at Rs. 70 million would yield an immediate return of Rs.30 million if the mortgage borrowers prepaid immediately. Since investors can reinvest the Rs.30 million, this early return will have a greater return per period than a Rs.30 million return that is spread out over a longer period.

So, then we have another type of mortgage back security that is called the stripped mortgage back security. And this stripped mortgage back security consists of two classes. One is principal only another one is interest only. So, this principal only class security that generally receives only the principal from the underlying mortgages but if you are talking about the interest only class that receives just the interest.

And the return on the principal only mortgage-backed security is greater with greater prepayment speed. For example, a principal only class is formed with a value of the mortgages that is 100 million and price at 70 million would yield an immediate return of 30 million if the mortgages borrowers prepaid immediately.

Since, the investors can reinvest that 30 million this early return will have a greater return for period than a 30 million rupees return that is spread out over a longer period. Let that is the principal only class whatever we have formulated out of the 100 million mortgages. So, if the investor will get the 30 million, they can reinvest it and the always the early return will be greater than the greater return per period than a 30 million return which is spread over a longer period of time that already we know.

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So, because of the prepayment the price of the principal only mortgage back security tends to be more responsive to the interest rate changes than any option free bond. And if the interest rates are decreasing then like the price of the most bonds the price of the principal only mortgage back

security also will increase. And again, the price of the principal only mortgage-backed security is also likely to increase further because of the expectation of greater earlier principal payments.

The logic is basically what? This interest rate is declining the R is declining. So, if the R is declining then the prepayment will increase. If the prepayment will increase then the return will increase from that particular bond and the value of the principal only stripped mortgage back security will increase. And again, obviously you know that if there is a lower discount rate the value is increasing.

$$R(1) \Longrightarrow prepayment \uparrow \Longrightarrow return \uparrow \Longrightarrow V_{PO}$$
$$R\downarrow$$
$$(2) \Longrightarrow \text{lower discount rate} \Longrightarrow V_{PO}\uparrow$$

So, the lower interest rate will have the double impact one is the prepayment impact or another one is the discount rate impact. Because of the lower discount rate, the prepayment is also increasing. So, that's why this particular value is again further increasing because of that, one is because of change in discount rate or the lower discount rate and another one is the higher the repayments. So, that is what it has the double effect you can realize in that particular context.
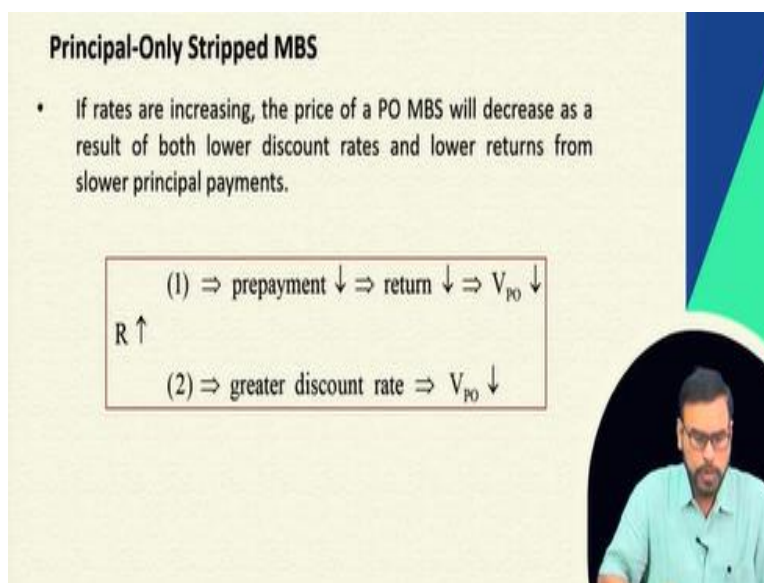
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If you assume the interest rate is increasing then reverse will happen. Here in this case the price of the principal only mortgage back security will decrease as a result of both discount rates and

the lower returns from the slower principal payments because the prepayment will go down. Whenever there is a higher interest rate the prepayment will go down. So, the prepayment will go down then obviously the return will go down then the value will go down.

And obviously because of the higher discount rate value itself of that particular bond are also going to be down. So, that's why again the both the effects basically will work in this particular context.

$$R(1) \implies prepayment \downarrow \implies return \downarrow \implies V_{PO} \downarrow$$
$$R\downarrow$$
$$(2) \implies \text{greater discount rate} \implies V_{PO}\downarrow$$

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Then we have the interest only stripped mortgage back security. See here what happens? The cash flow and the returns on the interest only mortgage-backed security will be greater if there will be slower prepayment rate. And if you inverse relationship between the prepayment speed and returns dominates the price and discount rate relation then the price of the interest only mortgage back security will vary directly with the interest rate. Let us see what the mechanism in that is.

Let the R is increasing that means the interest rate is increasing. So, obviously if the interest rate is increasing then your discount rate is increasing the value is going down. So, your prepayment is declining that's why your return is increasing then your value is going to be up in that case

because we are talking about interest. So, in that case if you consider this is the first effect and this is the second effect, then what you can see?

If the first effect is greater than the second effect then your delta V_{I0} divided by delta R will be greater than 0 that means the value is increasing. If the first effect is less than the second effect then the value will decline. So, which effect is dominating over what effect that will decide whether this particular value of that particular security is going to increase or it is going to decline?

$$R(1) \Longrightarrow prepayment \uparrow \Longrightarrow return \uparrow \Longrightarrow V_{10}$$

$$R\downarrow$$

$$(2) \Longrightarrow \text{greater discount rate} \Longrightarrow V_{10}\uparrow$$

If 1st effect $> 2^{nd}$ effect, then $\frac{\Delta V_{10}}{\Delta R} > 0$

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Nonagency Residential MBSs, Commercial MBSs, and Other Asset-Backed Securities

- The most common types are nonagency residential MBS, commercial MBSs, and asset-backed securities backed by automobile loans, credit card receivables, and home equity loans.

- These asset-backed securities are structured as pass-through and many have prepayment tranches.

- Different from agency MBSS, the collateral backing these asset-backed securities are subject to credit and default risk.
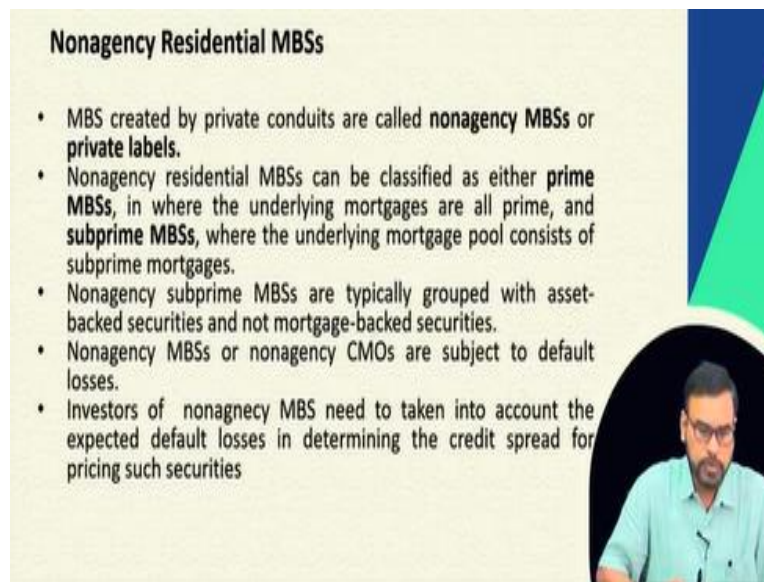
Up to now we are discussing about the agency based residential mortgage-backed securities. Then we have some non-agency residential mortgage-backed securities, commercial mortgage-backed securities and some other asset backed securities. If you see the most common types of the non-agency residential mortgage-backed securities if you see there are largely available.

These are non-agency residential mortgage-backed securities commercial markets back securities, asset backed securities. And all are backed by the auto mobile loans, credit card

receivables, home equity loans and all these things. And this asset back securities are structured as pass through and many have the prepayment tranches. It is different from the agency-based mortgage-backed security because the collateral backing this particular asset backed securities are subject to credit and the default risk.

Because they are not backed by the government agencies, there is a chance of the default risk with respect to this type of securities.

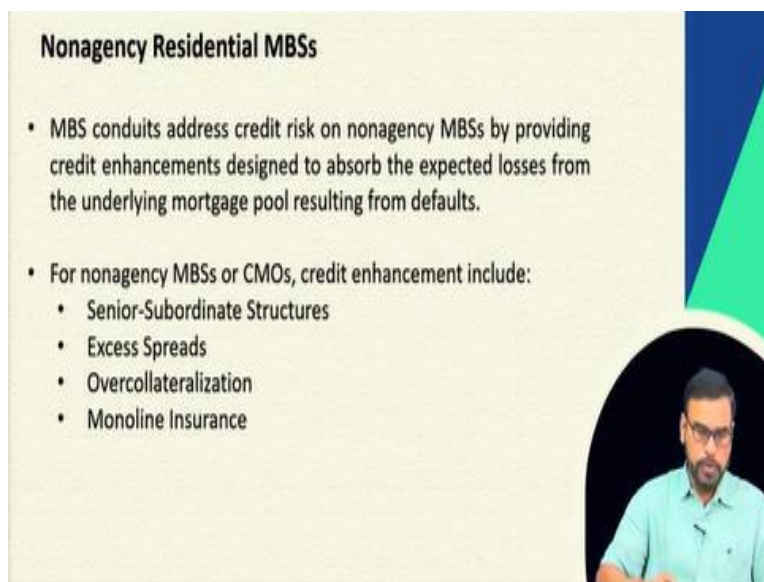**(Refer Slide Time: 25:42)**

So, let us start with the non-agency residential mortgage-backed securities then we can move towards the other type of asset backed securities. This mortgage back security is generally created by the private conduits that are why they are called the non-agency mortgage back security or the private labels. And this non-agency residential mortgage-backed securities can be classified either a prime mortgage back security. Why we call it the prime? Because the underlying mortgages are all prime that means the high rating assets are there or high rating loans are there.

And the subprime mortgage back securities where the underlying mortgages are basically consist of these subprime mortgages. And the subprime mortgages means relatively the quality of these mortgages is relatively low. So, the non-agencies subprime mortgage back securities are typically grouped with asset backed securities not the mortgage-backed securities.

And there basically non-agency mortgage-backed securities are the CMOs the collateralized mortgage obligations are subject to default losses. Because there is a default risk or the credit risk involved in that so that's why they are subject to default losses. That's why the investors of the non-agency mortgage-backed securities always needs to consider the expected default losses in determining the credit spread for pricing such securities.

So, the expected credit losses from that particular security have to be taken into consideration whenever the pricing of this particular security are done.

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So, non-agency residential mortgage backed securities if you see, the general what happens the private players address the credit risk on this non-agency mortgage backed securities by providing a credit enhancement designed to absorb the expected losses from the underlying mortgage pool resulting from the defaults. And what are the different types of credit enhancement they give?

One is senior subordinate structures, excess spreads, over collateralization and monoline insurance, the insurance also they can provide. These are the different ways basically the credit enhancement of the securities can take place and which can be provided by the private conduits.

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Senior-Subordinate Structures

- A MBS issue with a senior-subordinate structure is formed with two general bond classes: a senior bond class and a subordinated bond class, with each class consisting of one or more tranches.

Bond Class	Tranche	Principal (Rs)	Credit Ratings
Senior	1	300	AAA
Subordinate	2	25	AA
Subordinate	3	25	A
Subordinate	4	20	BBB
Subordinate	5	10	BB
Subordinate	6	10	B
Subordinate	7	10	Unrated

Let us see what this senior subordinate structure is all about. A mortgage-backed security with a senior subordinate structure is generally formed with two general bond classes, a senior bond and a subordinated bond. And each bond is consisting of one or more tranches. Let there are seven tranches here in this example, you have two types of bond classes. One is senior another one is subordinate.

Senior tranche let 300 is the principal and this tranche is consisting of all triple rated ratings and other tranches let second subordinate bonds tranche basically is consisting of 25 million or this is double A, another is 25 single A, 20 triple B, then 10 double B, then 10 single B then last term is unrated. So, then what will happen?

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Senior-Subordinate Structures

- For this MBS issue, the default losses are absorbed first by Tranche 7 (starting at the bottom) and ascend up.
- If losses on the collateral are less than Rs. 10 million, then only Tranche 7 will experience a loss
- If losses are Rs. 30 million, then Tranches 7, 6, and 5 will realize losses
- The senior-subordinated structured MBS spreads the credit risk amongst the bond classes. This is referred to as **credit traunching**.
- The rules for the distribution of the cash flows that include the distribution of losses are referred to as the **cash flow waterfalls** or simply **waterfalls**.

For this issue the default losses are absorbed first by tranche 7 which is in the bottom then ascend up. If losses on the collateral are less than 10 million then only tranche 7 will expire a loss. They will basically experience the loss other tranches will not experience any loss. If losses are 30 million then tranche 7, 6, 5 will realize the losses. And the seniors subordinated structured MBS generally spreads the credit risk among the bond classes.

The credit risk is basically divided over the different bond classes which are considered for that particular kind of security and that basically referred as the credit trenching. The rules for distribution of the cash flows include the distribution of losses generally as referred as the cash flow waterfalls or simply the waterfalls. So, this is the concept what basically we can use in the context of the senior subordinate structure.

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Senior-Subordinate Structures

- The proportion of the mortgage balance of the senior bond class to the total mortgage deal is referred to as **senior interest** (initial senior interest = Rs. 300m/Rs.400m = 0.75)
- The proportion of the mortgage balance of the subordinated bond classes to the total mortgage deal is referred to as **subordinate interest** (initial subordinate interest = Rs. 100m/Rs. 400m = 0.25).
- The greater the subordinate interest, the greater the level of credit protection for the senior bond.

So, let us see the proportion of the mortgage balance of the senior bond class to the total mortgages 0.75 that is 300 million divided by 400 million, 400 million the total. Then the proportion of the mortgage balance of the subordinate bond is 100 by 400 that is 0.25. So, that is called the senior interest and this is called the subordinate interest. Greater the subordinate interest greater the level of credit protection for the senior bond.

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Senior-Subordinate Structures

- Over the life of the MBS deal, the level of credit protection will change as principal is prepaid.
- In general, with prepayment, senior interest will increase and the subordinate interest will decrease over time.
- Because of this, most senior-subordinate structured MBS deals have a **shifting interest schedule** designed to maintain the credit protection for the senior bond class.
- Shifting interest schedule is used to determine the allocation of prepayment that goes to the senior and subordinate tranches.

So, now the over the life of the MBS deal, the level of the credit protection will change as the principal is prepaid. So, with prepayment the senior interest will increase and the subordinate interest will decrease over the time. So, because of this most senior subordinate structured MBS

deals have a shifting interest schedule designed to maintain the credit protection for the senior bond class.

And this shifting interest schedule is used generally to determine the allocation of the prepayment that goes to the senior and the subordinate tranches. How basically it happens?

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The senior prepayment percentage is nothing but the initial senior interest per cent plus your initial subordinate interest into the shifting interest proportion. So, let if you assume years after issuance 1 to 3 the shifting interest percentage is 100%, in year four it is 60%, year five 50%, year six 30%, year seven 20%, year eight 10%, after eight it is 0. So, if you go by this schedule the 100% prepayment would go to the senior class for the first three years that will be 75% plus 25% into 1.

If you go to year four it will be initial senior interest bond is 75% plus initial subordinate interest is 25% into 0.6. What will be there? Because it is 60%. Then how much? 25 into 0.6 it will be how much? 25 into 0.6 that means 15, 75 + 15 this is 90% that is correct, this is 0.6. Then your five it will be 75% into 25% into 0.5 that will be 87.5% and so on.
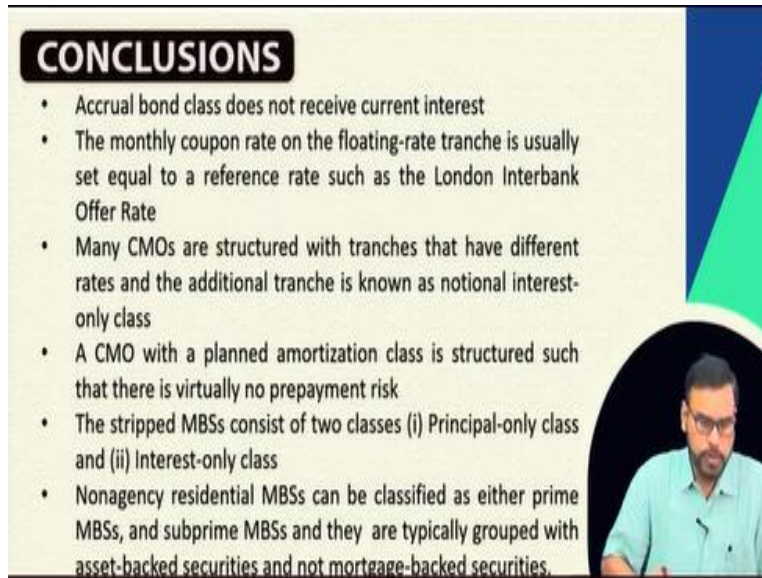
!00% of the payment would go to the senior class for the first three years [75 %(1) (25%) =100%]

90% in year 4(75%+0.10)

87.5% in year 5,and so on.

Then after year eight the allocation or principal between the senior and the subordinate classes should match their initial senior and subordinate interest principal of 75% and 25%. So, the shifting interest schedule from hundred per cent to 60% in year four, 50% in year five to finally 0% after year eight is known as the step down provision. So, such provision basically allows for reduction in the credit support over the time.

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So, the conclusion what basically we have discussed in today's class the accrual bond class does not receive any current interest. The monthly coupon rate on the floating rate tranche is usually set equal to the reference rate like the LIBOR. Many CMOs are structured with tranches that have different rates and the additional tranche is known as the notional interest only class. The CMO with planned amortization class is structured so that there is virtually no prepayment risk.

The stripped mortgage-backed securities consist of two classes one is principal only class and interest only class. Then, non-agency residential mortgage-backed securities can be classified as either prime mortgage-backed security and the subprime mortgage-backed security and they are typically grouped with asset backed securities not with the mortgage-backed securities. So, further we will continue with this particular discussion with respect to the other aspects of this.

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These are the references.

Thank you.