Management of Commercial Banking
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Lecture 14 - Valuations of Fixed Assets 2

In the previous class we discussed about certain concepts related to simple and compound interest rate and as well as the different methods which are used for the valuation of the bonds.

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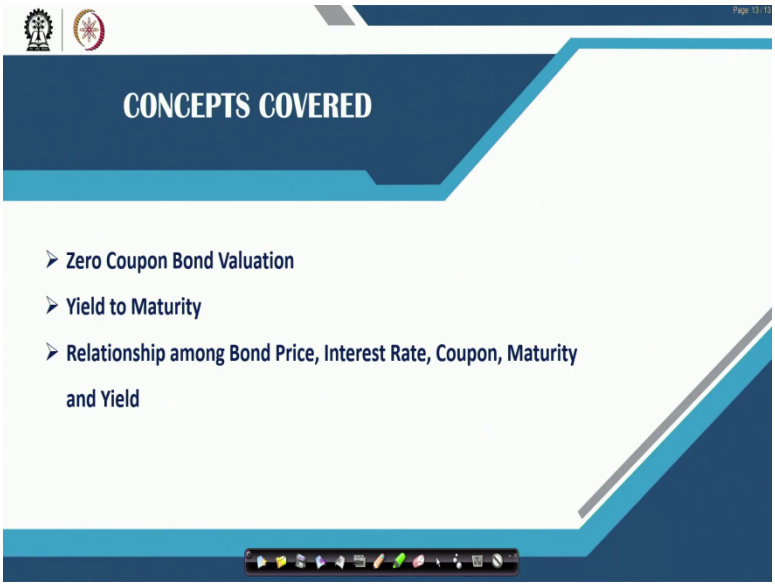

In today's session will be discussing about certain concepts like how we can go for valuation of Zero Coupon Bond because in the previous class we discussed about the valuation of the bond who which carries the regular payments of the coupon or the periodic cash flows are received from that. But a there are certain bonds where always issued at discount and redeemed at par, so if that is the case then how the valuation of those bonds are basically done. Then obviously you might have heard that the very famous concept of yield to maturity because whenever we talk about the bond valuation the most important concept is yield to maturity.

So what exactly the yield to maturity is and how the yield to maturity is calculated so that is another concern for the investor and as well as the bond issuer that how the yield to maturity can be considered whenever the bond investments are made in the market, including the banks whenever they invest in the bond or they issue the bond they are also much more concerned about the yield to maturity.

Then also will discuss about certain concepts or certain relationships which are basically always established between the bond price, interest rate, coupon, maturity of the bond and the yield. So these are basically tells you that what kind of investment strategy the particular investor or banks can make whenever they want to invest in the different type of fixed income securities which is existing in the market.

So these are the different concepts which are very important from the security valuation point of view whenever specifically talk about the fixed income securities. So these are the things what will be will be discussing today. Today's season will discuss about all this is issues.

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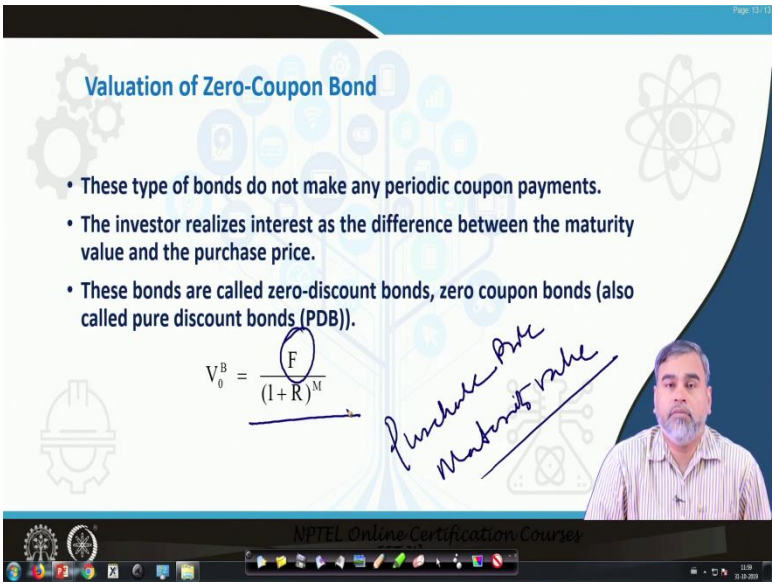

Let us see that already told you there are certain bonds which do not pay any periodic coupon payments because the bond is there is a purchase price and there is a maturity value and there is no such payments received in the beginning.

Then for that bond how that particular valuation or the value of the bond can be calculated. So the investor basically what they realizes the interest as the difference between the maturity value and the purchase price.

So obviously these are the zero discount bonds because there is nothing to be discounted in between and zero coupon bonds are basically called the pure discount bonds. Here instead of talking about the periodic coupon payments where only there is a purchase price of that particular bond. There is a purchase price and there is a maturity value and this maturity value is nothing but the face value of that particular bond.

What basically we are going to get from this. So therefore if you want to go for valuation of this kind of Bond this is basically nothing but you have to discount that face value with respect to the interest rate which is prepared in the market for the discount rate and the maturity period is given then this is nothing but that F by 1 plus at to the power M. M is equal to the period of the maturity. So therefore here only one component is added whenever the evaluation of the zero coupon bond because the periodic cash flows are absent in this particular case.

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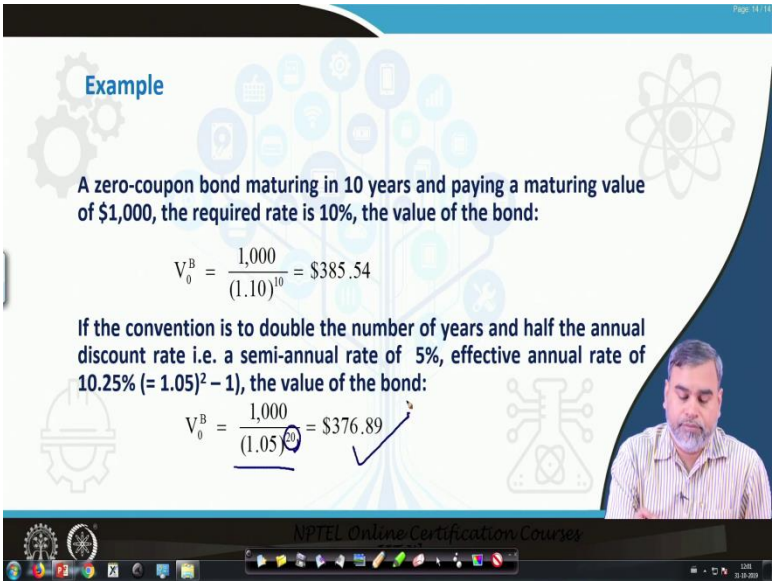

So if you see this example there is a zero coupon Bond which is going to be matured in 10 years paying a maturity value of 1,000 dollar and the required rate of return is 10 percent on the discount rate is 10 percent. Then the value of the bond is nothing but 1000 divided by 1.1 to the power 10 in that will give you 385. 54.

That means if you buy the bond at the price of 385. 54 with 10 percent discount rate you will be getting your future value of the particular Bond will be 1,000 dollar after 10 years. So if the convention is the double the number of years and half the annual discount rate then what basically you can get the semi annual rate will be 5 percent and the period will be double and effective annual rate will be 1.05 to the power 2 minus 1 that will be 10.25 percent.

So if we are we want to discount it semiannually then the value of the bond will be 376.85 because your number of periods as increased up to 20 and your discount rate has become 5 percent. So it will be 1000 divided by 1.05 to thee power 20 that will give you 376. 89. So this is about the valuation of the zero coupon Bond.

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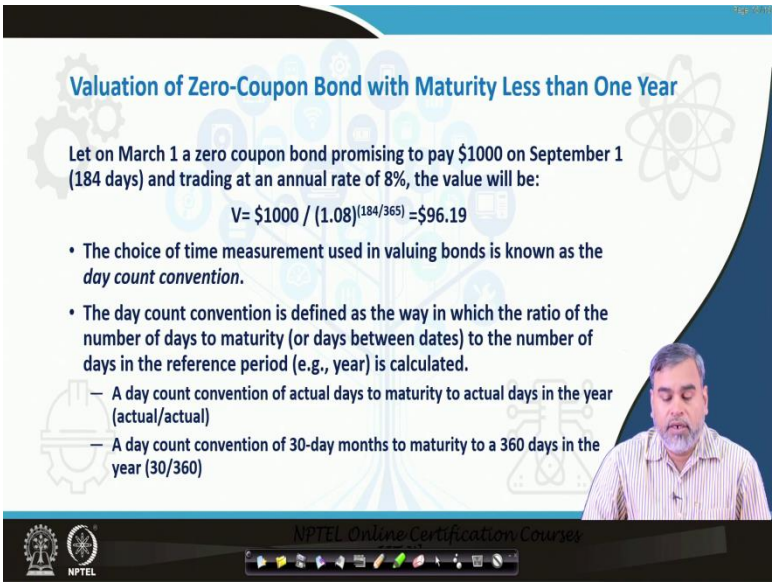

But if the particular bond there is a zero coupon Bond where the maturity period is less than 1 year because we have considered about the valuation of the bond whose maturity period is 1 year or more than one year because of that we are directly taking the discount rate for yearly basis and we have to discount it with respect to a particular discount rate and after maturity we are trying to find out the price.

So if there is a bond who is let the zero coupon Bond which was purchased on the March 1 and it has promise to pay 1000 dollar on September 1 and it is the trading in the market at annual rate of that particular time the market interest rate was 8 percent. Then what is the value? because it is only 184 days from March 1 to September 1 So then we have to find out or we have to discount it with respect to that time period then the value of the bond will be 1000 divided by 1.08 to the power 184 by 365.

So 184 by 365, 365 because there are 365 days actual days we have considered. Then 184 by 365 that will give 96.18 19. So the choice basically what either we sometimes we may consider 365 and sometimes also people consider 360.

So the choice of time measurement which are used for valuation of the bond is popularly known as the day count convention. The choice of the time measurement which are used generally for the valuation of the bond is known as the day count convention and the day count convention is basically what it is basically the ratio of the number of days to maturity or the days between the dates.

So what date this investment has been started and what date this particular bond will be mature. So exact number of days we consider and accordingly the day count convention will be decided. So if the day count convention of actual days to the maturity then it will actual by actual but if day count convention of 30 day months to the maturity then always be considered 30 by 360 because 30 days means you are talking about 30 into 12 360 days.

So accordingly the day count convention of 30 day month to maturity tour 360 days in a year is basically considered as 30 by 360. So whether you are going by actual by actual or you go by the 30 days month in a month that also the investor has to decide while calculating the price of that particular Bond.

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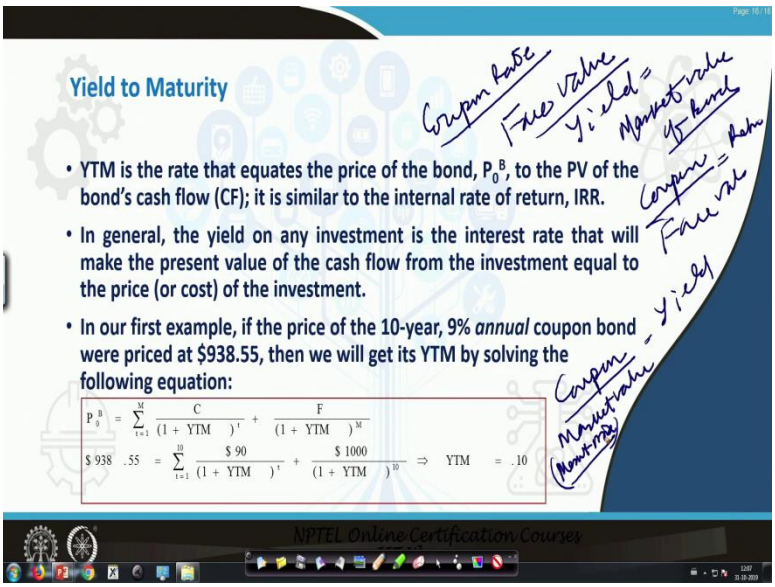

The another concept is yield which is quite important from the bond investment point of view whether it is banks or individual investor or any kind of issuer they always concerned about the yield to maturity. You remember one thing that there are two things we call at the return and or the rate of interest and another one is yield another one is yield.

So there is a difference between this two you remember that whenever we talk about the coupon rate so this is a rate. So whenever to talk about the interest rate we basically consider on the basis of the face value of the bond talk about the face value of the bond.

But whenever we talk about the yield the yield is basically calculated on the basis of the market value of the bond. So your coupon payment divided by the face value that will give you return. But whenever you talk about the coupon, so whenever we talk about the coupon

upon the market value that will give you yield. That will basically give you yield. So yield is always is considered with respect to the market value or the market price. It is basically the market price or the price of the bond.

So the market price coupon upon market price that will give you the one type of yield that is called the coupon yield sometimes we call it the current yield and whenever you to talk about the interest rate or the return those are basically calculated on the basis of the face value of the bond.

So 9 percent is the for example previous example if you see in the previous example whatever we have seen the 9 percent in the coupon how it is done? They 90 divided by 1000 that is 9 percent that is the coupon. But if you talk about the current yield of that particular bond it is 90 divided by 938.55.

In the previous example whatever in the previous session whatever we have taken the value of the bond at 9 percent coupon ten percent discount rate 10 years maturity and with thousand face value the value of 938.55 if you remember and previous session we discussed that and now if you want to find out the current yield of that particular bond the 90 divided by 938.55 that will give you the current yield.

But whenever you talk about the yield mostly the yield concepts are popular in terms of the yield to maturity. Then what exactly the Yield to maturity is? The yield to maturity is basically what it is the rate which equates the price of the bond to the present value of which is nothing but to the present value of the cash flows and it is similar to the internal rate of return in the financial management and other places whenever we talk about the IRR it is synonyms to that.

So in general the yield on any investment is the interest rate that will make the present value of the cash flows from the investment equal to the price of the investment. So if the price of investment which were interested equates the price of the investment equal to the present value that will be considered as the yield to maturity.

So in the previous example if you see 10 years maturity 9 percent annual coupon which was price start 938.55 just now what we are discussing then if you solve. For example 938.55 which was given to you then the coupon payments are given to you. Then if you want to calculate you R. R is nothing but the YTM then if you solve this particular thing that will be

coming 10 percent. So this is the way the yield to maturity is considered yield to maturity is calculated.

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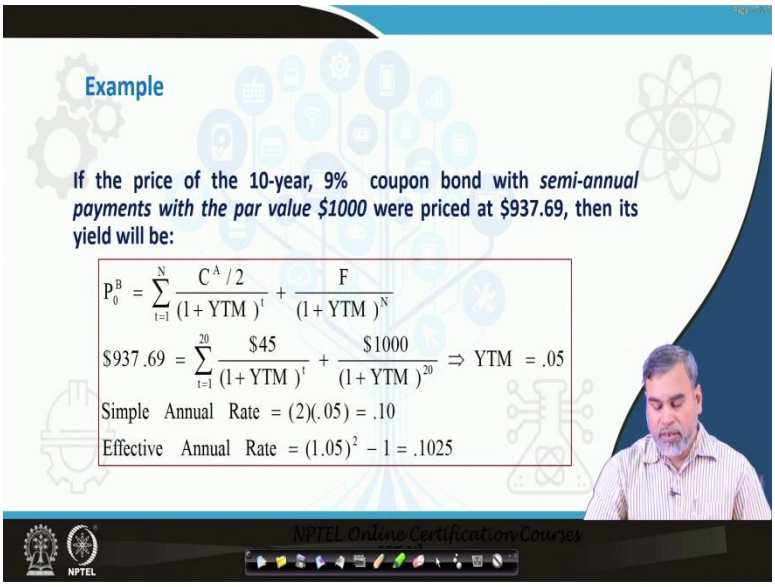

But the question here is it is relatively difficult to calculate that why we because it has to be calculated on the trial and error bases which will be exactly equalize the present value of the cash flows with the market price which is already prevail in the market.

So in this case if you go for the semiannual basis you will find that again the same thing, 45 divided by 1 plus YTM to the power t 1000 divided by 1 plus YTM to the power 20 and your market price was 937.69 whatever already we have calculated you find that it is 5 percent with simple annual rate it will be 10 percent. But if you go for effective annual rate that will be 1.05 to the power 2 minus 1 that will give you 10.25 percent.

So that is the way the particular Yield to maturity is considered but just now I said that it is relatively difficult to calculate the yield to maturity because that has to be calculated on the basis of the trial and error basis so if you want to calculate on the basis of then it trial error basis it will be relativity complex in nature to find out.

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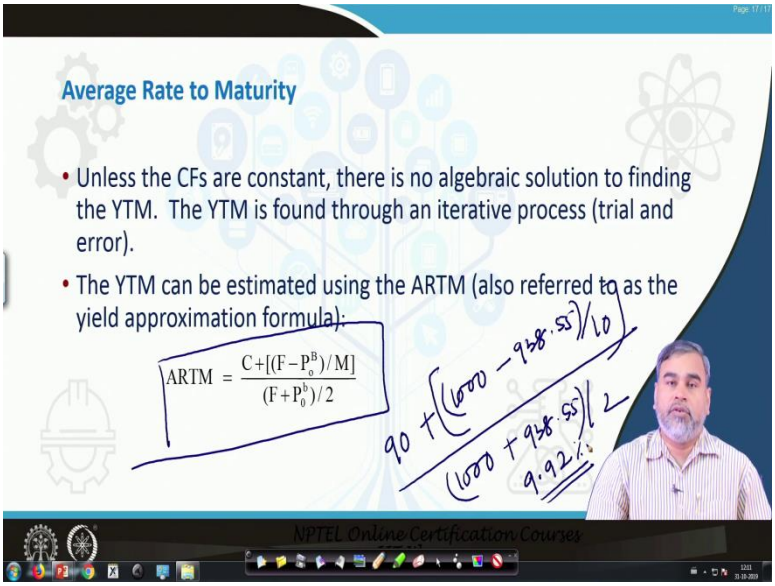

Then approximate yield to maturity if you want to calculate then how basically you can calculate we take the help of the average rate to maturity. So whenever we go for average rate to maturity what basically we do we go for this formula to use this average rate to maturity.

So in this formula we consider the coupon plus the is face value of the bond minus the market price divided by the maturity for example in this example if you consider C is equal to 90 plus F is equal to 1000 minus 938.55 which is the price of the bond divided by M is equal to 10 whole divided by 1000 plus 938.55 divided by 2.

So if you consider this then this value will be very much close to that particular yield to maturity if you calculate it will be coming around 9.92 percent. What actually yield to maturity in our case was 10 percent that is why I said in the trial and error basis if you want to find out a closed discount rate which can equalize that then this average rate to maturity is approximate yield to maturity you can calculate using this particular formula.

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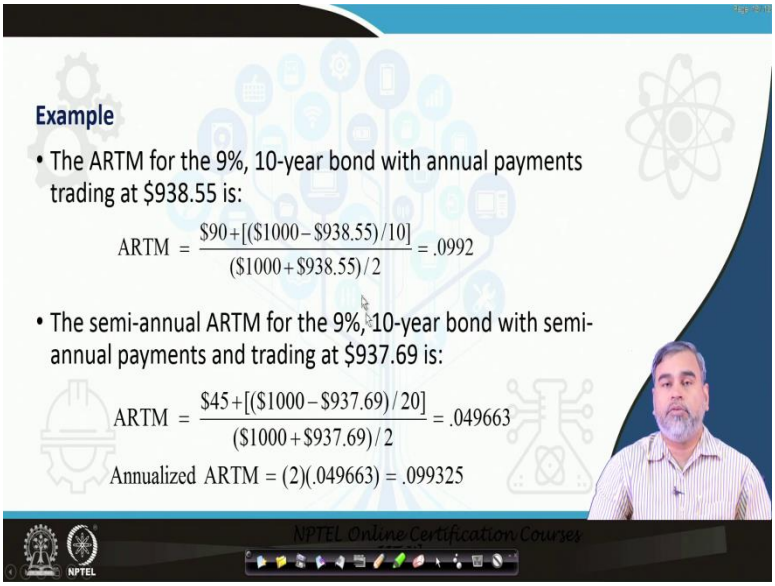

Then if you see that in this case just now 9.92 percent just now already it is calculated. If you go by the semiannual way it will be 9.3 percent because there is some differences in terms of the pricing of the bond that already we have discussed.

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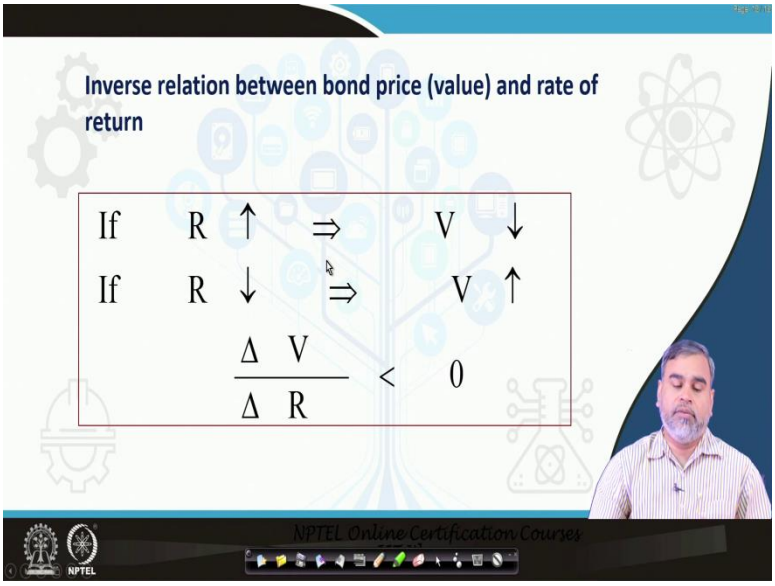

So there is a relationship just now whatever we have seen we have seen that the particular price of the bond is determined by the rate of interest, the coupon, the maturity, the term to maturity then as well as the cash flow that already we have seen.

So in this case if you want to see whatever we have seen you R is coming in the denominator. So obviously if you R is increasing then the value of the bond will decline. So therefore there is an inverse relationship between the bond prize and the rate of return.

So the rate of return is increasing then value of the bond is declining the rate of return is declining the value of the bond is increasing. That means the Delta V Delta R is less than 0. See 1 percent increase in the rate of interest will decline the value of that particular bond. So that is why the slope is always less than 0 or it is negatively sloped.

So this is what basically what we can say that there is a there is an inverse relationship between the price of the bond or the value of the bond and the rate of return that already it is clearly visible from this particular formula.

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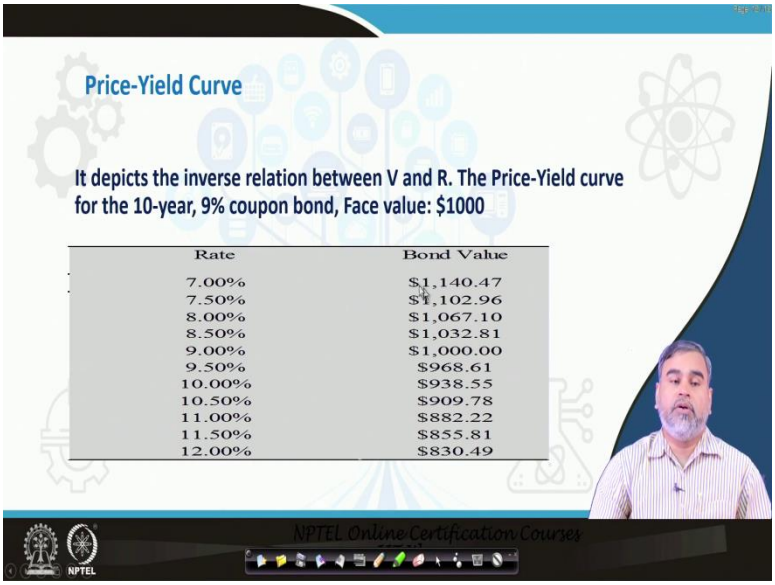

Just now in the same example whatever we have taken if you see that in the case of 10 percent it is 938.55. So once we are increasing this rate of return if you see the value is declining from 10 to 10.5 to become 909.78, from 11 to 11 it is 822.22 like that.

But whenever we are declining the interest rate you see that it is increasing so this is what basically what we can observe whenever we establish the relationship between interest rate and the price of the bond.

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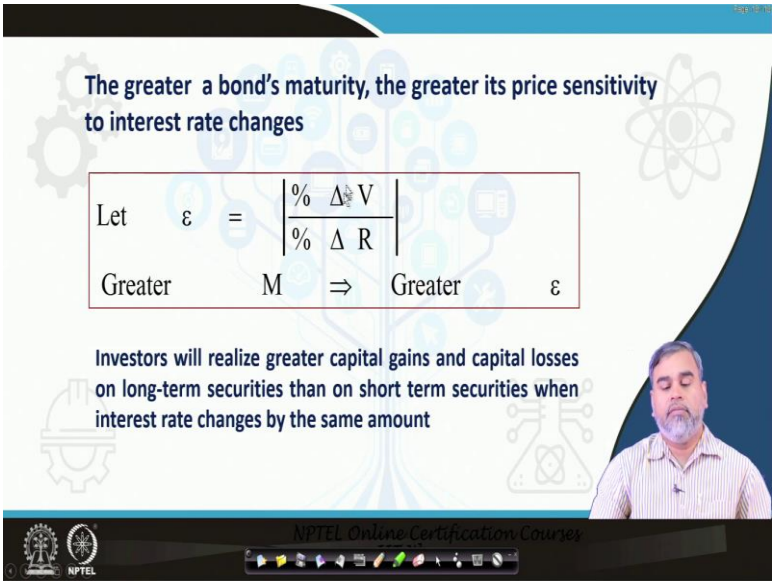

Another interesting observations we have the greater a bonds maturity the greater its price in sensitivity to interest rate changes. If the interest rate will change in the same percentage in the two different bonds in one bonds maturity period is more than the another Bond what basically we can observe we can observe that the if one bonds maturity period is more than the maturity period of another bond then what we can observe that whenever there is a change in interest rate the fluctuations of the value the percentage change in the value is always more for the high maturity bonds than the low maturity bonds.

So from this what kind of strategy we can adopt the investors basically always will realize greater capital gain and capital losses on long term securities than this short term securities when interest rate basically changes by the same amount.

That is why the long term investments we consider as riskier than the short term investments because if there is a change in interest rate then obviously the long term the price fluctuations price volatility will be more for the long term interest rates on long term bonds than the short term bonds. That means the their percentage change in the value divide by percent change in the interest rate is basically always greater whenever the M increasing. So greater M greater the epsilon. The epsilon is represented as percentage change in the value of the bond divided by the percentage change in interest rate.

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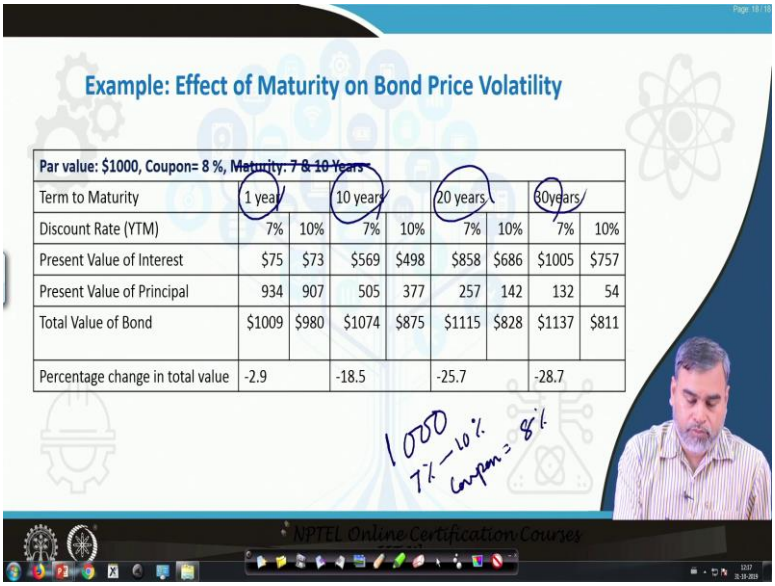

You see this example then it will be more clear. Let there is a Par value of the bond is 1000 the coupon is 8 percent, maturity is one bond is 7 years another one is 10 years. Then if you observe there is a one year bond, 10 years Bond, 20 years bond, 30 years bond if you consider then you will find that whenever the interest rate in changing from 7 percent to 10 percent then you will observe that the percentage change has if it is a 1 year maturity bond the percentage change in the value is 2.9.

The value has decline value has decline by 2.9 percent but whenever it is a 10 years Bond whatever we have observe it is basically we observe that it is minus 18.5 from 1 year to 10 year if maturity is changing when it is minus 18.5. If it is a 20 years Bond then it is again 25.7 percent. If 30 years Bond it is 28.7 percent. So more the maturity with the same level of interest rate changed from 7 percent to 10 percent, 7 percent to 10 percent we observe that the value of the particular bond is changing.

So here if you want some what is the data here your par value is 1000 your par value is 1000 then we have the discount rate we have we are changing from 7 percent to 10 percent and here the coupon is 8 percent and we are talking about the different maturity like one year maturity 10 years maturity 20 years maturity 30 years maturity we can discard this one it is one year 10 year 20 years 30 years maturity we are considering with the different maturity we are getting how the percentage change in the value is basically happening. So it is clearly, we

have observed that the particular bonds fluctuation price value fluctuations are more whenever the bonds maturity period is more.

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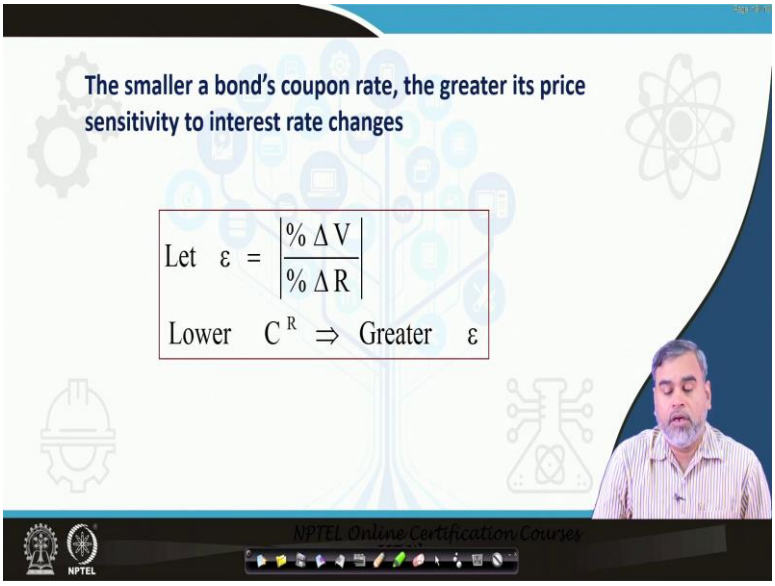

Then another interesting observation we have the smaller the bonds coupon rate greater its price sensitivity to the interest rate changes. If there are two points which are available 1 bond is coupon rate is high in another bond the coupon's rate is low you will observe that if the coupon is increasing then you will find the sensitivity of the bond will be lower. But the coupon is lower the sensitivity of the bond price change will be higher.

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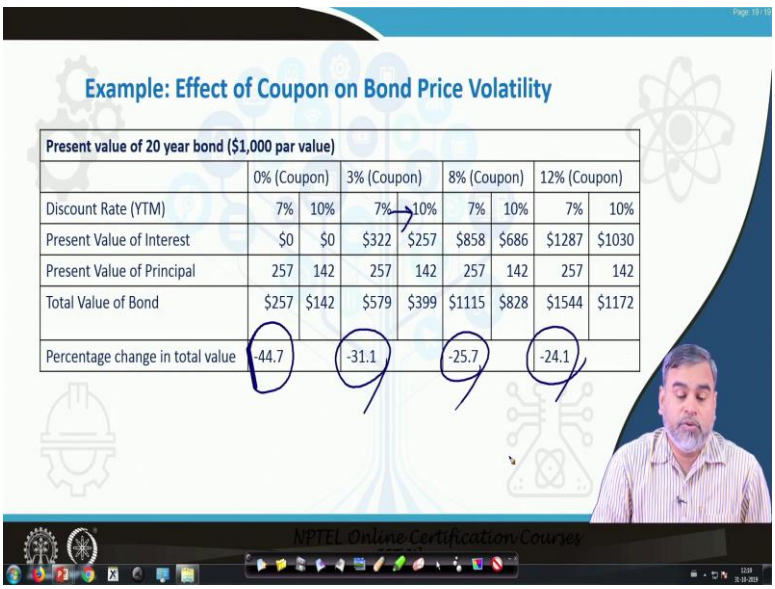

So in this case if you see this example it will be more clear. There is a bond which prepare value is 1,000 dollar and your discount rate is 7 percent, 10 percent we are changing it at the 7 percent at the 10 percent. So first bond there is no coupon so whenever the interest rate in changing from 7 percent to 10 percent what we have observed the percentage change in the total value has become 44.7 percent. But whenever the coupon was 3 percent whenever interest rate has changed from 7 percent to 10 percent you will observe the value of value has changed by 31.1 percent.

Whenever the 8 percent coupon is 25.7 percent and whenever it is 12 percent coupon rate the value was changed by 24.1 percent. Then what basically we have got from this higher the coupon the price sensitivity will be lower, than the lower the coupon the price sensitivity will be higher. So in the zero percent coupon the price sensitivity was 44.7 if there is interest rate changed from 7 percent to 10 percent.

But whenever it is a 3 percent coupon the price the change in the value was of 31.1 percent but whatever it is a 12 percent coupon it is only 24.1 percent. So it is clearly visible from this that whenever the coupon is lower the price in sensitivity will be higher if there is a change in the interest rate.

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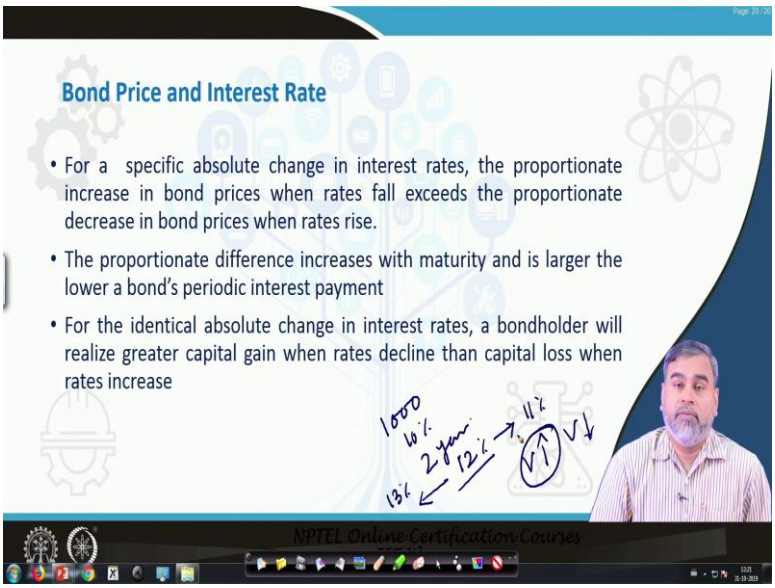

Then we have another thing that bond price and interest rate. So for a specific absolute change in interest rate the proportionate increase in the bond prices when interest rate falls exceeds the proportionate decrease in the bond prices and interest rate rises. What basically it

means it means that let the interest… There is a bond whose par value is 1000 rate coupon is 10 percent then the maturity period is related 2 years and market interest rate is 12 percent.

So if the market interest rate will change from 12 percent to 11 percent then the value of the bond will go up. But the market interest rate will increase to 13 percent then the value will go down but the percentage change in the increase in the price due to the decrease in interest rate is always more than the percentage change in the decrease in the value of that particular Bond due to the increase in interest rate.

That means the impact of declining on the interest rate will be more on the value of the bond than the increase in interest rate in that particular scenario. So the proportionate differences with maturity and it is larger the lower bonds periodic interest payments.

For identical absolute change in interest rate and bondholder will always realize greater capital gain when the rates are declining then the capital loss when the rates are increasing. So the investor is always much concerned about the decline in interested because this has more impact on the value of the Bond than the increased in interest rate in the market. That basically is another observations that we can draw whenever the banks or any kind of financial services company invest in this particular market.

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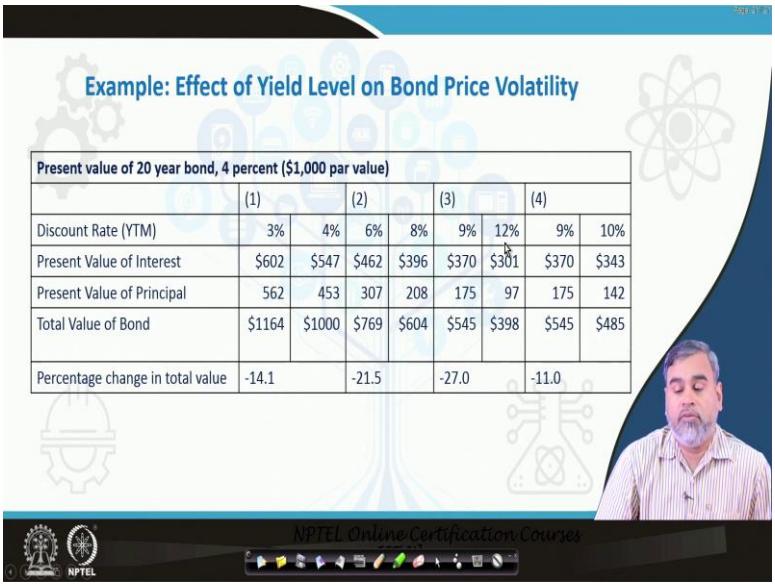

So if you talk about the yield what is the impact of yield on the bond price volatility you will observe that in this case there is a present value of 20 years bond. Bond maturity period is 20

years the coupon is 4 percent then the par value is 1000. If you see that the whenever that yield rate was 3 percent if R it has is increased from 3 percent to 4 percent.

The value has become 1 percent change the value was changed from 14 to 1 14.1 percent. But if you see that the discount rate was 9 percent then again it has increased to 10 percent the same one person change you will observe that the value has changed by 11.0 percent.

So that means at the lower discount rate whenever there is a change of the interest rate you will observe that the percentage change in the total value is higher if the discount rate is lower. But if the discount rate is already higher and from higher to further again it is growing up then the change is basically relatively less.

The same thing you can observe here whenever it was going from 6 to 8 will find 21.5 2 percent change. But here if you see it is there is a 3 percent change since from 9 to 12 it is only 27 percent.

So that is why here what we can conclude that if in the lower yield if there is a change in interest rate then the impact on the total value of the particular Bond will be more than the whenever the discount rate for the yield will be higher.

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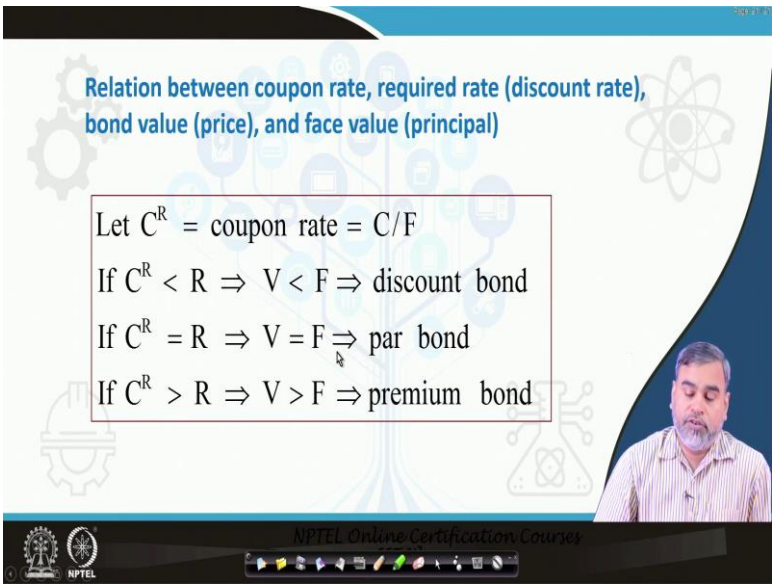

So then another thing you might have observed that we can have three types of bonds. One is your discount Bond, we have a premium Bond and we have a par bond. So what is the basic

difference between the three basic difference between this three are if the coupon is equal to your discount rate then your price of the bond will be equal to your face value. If your coupon rate is equal to your discount rate then obvious previous case for example instead of 9 percent coupon you have considered 10 percent coupon and 10 percent is the discount rate then the value of the bond also in 1000 instead of 938.55 the value of the bond will be 1000. So this is called the par bond.

But if the coupon is lower than the discount rate coupon is lower than the discount rate than the market value the bond is less than the face value or the par value. Already we have realized that that the coupon was 9 percent and the discount rate was 10 percent the face value was thousand but the value of the bond was 938.55 in the previous example.

So that time it is the value of the bond is less than the face value that is why it is called the discount bond. Then we have reverse one if the coupon rate will be more than the discount rate then obviously you will find that the value of the bond will be more than the face of the bond. So that is called the premium bond.

So depending upon the relationship between the coupon and the yield or the rate of interest we can define that which bond can be discount bond, which bond can be par bond and which bond can be premium bond. So this is the observations what we can draw whether the bond is issued at discount or the bond is issued at premium on the bond is issued at par.

So once it is written Bond issued at par that means the coupon is equal to the discount rate but if the bond is issued at discount then obviously coupon will be lower than the discount rate, bond is issued at premium then coupon will be more than the discount rate. This is kind of implications you can draw from this kind of relationship. So this is what the relationship between coupon, the required rate, the discount rate, bond value and the phase value or the principal amount.

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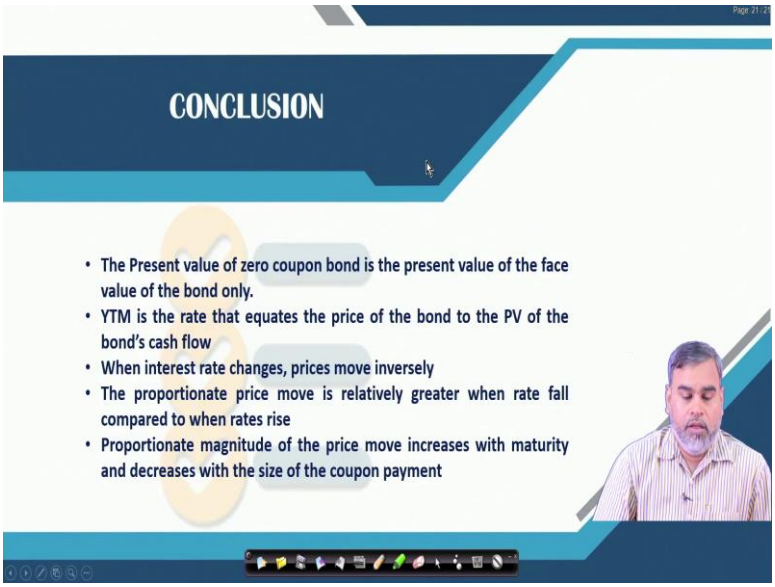

So then after discussing these things whatever we can get it from this particular session the present value of a zero coupon bond is the present value of the face value of the bond only. YTM is the rate that equates the price of the bond to the present value of the bonds cash flow. When interest rate changes the prices basically move inversely. The proportionate price move relatively greater than the rate fall compared to the when rate rises.

That is a clear cut indication or the strategy what the bond investor including banks can use whenever they invest in the fixed income securities market. Then the proportionate magnitude of the price move increases with maturity and decreases with the size of the coupon payments and as well as also we have observed lower the coupon higher the sensitivity.

If the there are two bonds one bonds coupon rate is relatively lower than the another Bond then if there is a change in interest rate the sensitivity of the price of the particular Bond or the low coupon Bond will be always more than the sensitivity of the price of the bond with high coupon bond with high coupons. So these are the different conclusions what we have drawn from this today's discussion.

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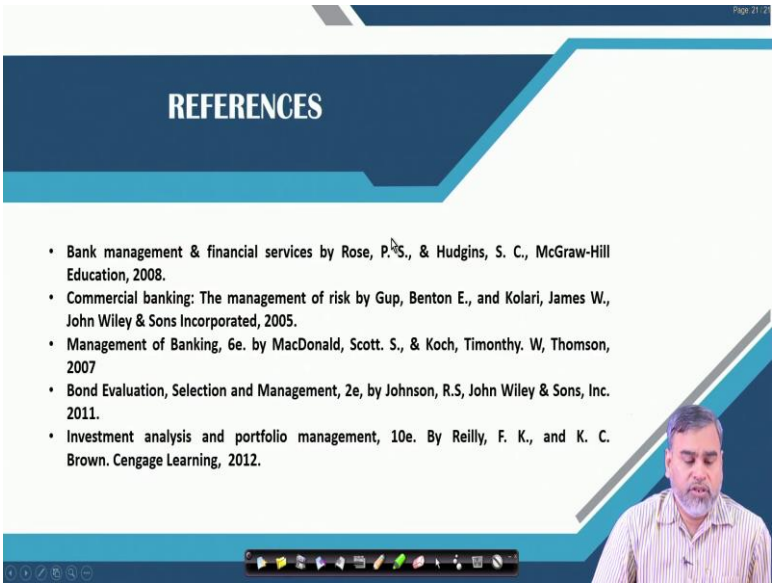

So these are the, references you can go through for the detailed analysis. Then further will be discussing about certain concepts related to how to calculate the total return from the bond and how the volatility or the price volatility of the bonds can be calculated and what is the concept of durations and what are the major factors which affecting the bond Returns. Thank you.