Fixed Income Securities

Reference Handout

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1 Introduction to Fixed Income

When we look at a business's need for capital, the following categories exist: The Capital sourced in the Primary Market is for two types of needs; Long term and short term .Within long term there are two different sources: equity and debt

Equity shares the ownership of the business with the investor. Debt is synonymous with LOAN: is repayable and involves interest, too. In the short term, we have money markets which are Short term loans. They need to be repaid and interest is chargeable on the loan as with any loan. Debt is available both for the short- and the long-term. Equity is not available as a short term source. Equity is discussed elsewhere. The debt universe, particularly fixed income and bonds are discussed here.

1.1.1 What are the promises that the Issuer of Debt makes to the Subscriber?

The core promise involved in DEBT is that:

- The owner of the paper will receive repayment of the amount loaned.
- Interest will be paid on the loan as per agreed rates and frequency
- The issuer will not do anything that adversely impacts the interests of the lender.

Debt Instruments Are Traded, Too! The Issuer Sells the paper in the market, and realizes cash; Other Investors – trade in the market as a continuous process. On Record Dates; Holders of the paper on this date get: Interest, if it is due; Loan repayment, if due.

The entire universe of debt instruments is best understood by categorizing it: They can be classified by maturity.

The life of the instrument is variously termed as: period, maturity, tenor – all mean the same.

- If the tenor is short term, the timeline is less than a year; and the categorization of the debt instrument is Money Market Instruments (such as; T-Bills, Certificates of Deposit, Commercial Paper).

- If the tenor is medium term, the timeline is 1 to 10 years; and the categorization of the debt instrument is : Fixed Income Securities ; such as (T-note, Corporate Notes)

- If the tenor is long term, the timeline is more than 10 years – typically, up to 30 years and the debt instrument is categorized as Bonds; such as (T-Bonds; Corporate Bonds)

Classifying the debt universe differently: The instruments can also be classified by who the ISSUER is; i.e. who took the loan. The borrower [Issuer] could be: Corporate, Government; or Others.

Combining 'Categorization by Borrower' with Categorization by Tenor' we get the following: Who took the loan: Corporate, government, or others.The tenor of loan can be short, medium, or long term.

- For corporate loans, These instruments are commercial paper, fixed income securities, and bonds, respectively.
- For government loans the short term instruments are T-bills, medium term instruments are t-notes and long term instruments are t-bonds.

- And under 'others', the short term instruments are certificates of deposit issued by a bank; municipalities are long term instruments issued by municipalities.

In conversation, when the term 'bond' is used it includes both medium and long term instruments. But it never includes short term instruments which are strictly referred to as 'money market instruments' only.

Short term loans issued in paper form are money market instruments, medium and long term instruments are bonds and fixed income, government loan instruments are Treasury, Gilt, Government Borrowing, T-bill, T-bond, Government Paper; and municipalities are Bonds issued by Municipal Corporations to fund local infrastructure projects.

1.2 Payment of Interest

Let us understand how interest is paid on bonds. And how interest is paid in money markets.

We now know the Fixed Income universe to represent loans taken. As with ALL loans, borrowers must pay interest to Lenders. The Issuer of the Paper is the borrower and the holder of paper is the lender. The Borrower pays interest to the Lender. Interest is also known as "Coupon" and applies as shown below. Face Value of Bond is The Loan Amount. Rate on bond (Interest/ Coupon) is the Interest on the loan: Dollar value of the coupon = Rate x Face Value. And the Period for which interest is payable Can be: quarterly, half yearly, or annually.

For Money Market Instruments, interest payment works out differently: Issue Price of the Instrument is the loan amount, Interest for the Period is the Interest on loan applied for the period: typically less than a year, and the maturity value is the Issue Price + Interest on the loaned amount. With Money Market Instruments: there is no periodic movement of money. Money moves once when the loan is given. Money moves again when the loan is repaid with interest.

1.3 Types of bonds

Let Us Now Look At Different Types of Bonds

1.3.1 What are Munis

'Muni ' is short for Municipal Bond. In the USA, municipalities, which are local bodies borrow money from the market to fund PARKS, bridges, libraries and schools… or, local infrastructure.

Municipality Borrows money. Issue Paper. Lenders Subscribe to the 'Muni". Give money

The municipality has sources of revenue

- It has regular local taxes
- It Charges user fee for the particular infrastructure created
- It could levy a Special Tax to repay the loan
- Or use a combination of these to repay loan

The Lender, now the holder of the bond can sell off 'Muni" in the Bond Market
Market Investors Buy the 'Muni". In which case loan repayment Goes to him. All lenders earn interest on loans they give. The 'Muni" too, pays interest.

1.3.2 Different Bond Types

- **FRN:**
  Floating rate notes pay interest/coupon which are linked to market benchmarks

- **Zero Coupon Bonds**
  Do not pay periodic interest. The bond pays principal plus interest at maturity.

- **Index Linked Bonds**
  Coupon payable are linked to an index rather than paid at a fixed rate. The coupon moves as the index moves. For eg: a consumer price index (CPI)

- **Medium Term Note**
  It is a hybrid between a Commercial Paper and a bond. Like a CP, an MTN is continually issued. Like a bond it matures at beyond a year and pays a coupon on a fixed or floating basis.

- **Convertible Bond**
  It converts to equity (stocks/shares) of the issuing company at a certain price and at certain times. Conversion depends on the market price of the share; the conversion rate has to be attractive to the bondholder. This opportunity to get shares at a preferred rate is offset by lower coupons.

- **Junk Bonds**
  A bond which has a very poor rating; the quality of the issuer is extremely low grade. The bonds trade at low prices and thereby offer high yields to investors

- **Brady Bonds**
  A term used to refer to bonds of Latin American countries which had poor credit standing. The bonds were supported by collateral of zero-coupon T-Bonds issued for the purpose.

- **Eurobonds**
  Is an issue In the International Bond Markets; The Market of issue is different from the currency of the bond. For instance, if It is USD denominated it would be issued outside the USA, or if it is Japanese Yen denominated, it would be issued outside Japan.

1.4 Issuance and Maturity of Bonds

We Shall Now See That Bonds Can Be Issued At Different Prices. That Bonds Can Be Redeemed Or Mature At Different Prices. And Scenarios That Result From The Combinations.

We consider the issuance price of a given bond and the price at which it is redeemed. We then consider the outcome for the investor and the issuer resulting from those combinations.

- In Scenario number 1, the Original investment is at 1,000 which is an Issue at PAR. The Bond is redeemed at 1,000, which is a Redemption at PAR. In this scenario the investor has no gains or losses associated with the issue price and redemption price.

- In Scenario number 2, the Original investment is 950, because the bond is Issued at a Discount: This is done to attract investors. The Bond is redeemed at 1,000, which is PAR. Whereby the investor gets an extra 50 to boost its yield from investing in the bond.

- In Scenario number 3, the Original investment is 1,000, Issued at PAR. And the Bond redeemed is at 1,050, which is a Premium. This too is attractive to investors as they get an extra 50 to boost the yield from investing in the bond.

- In Scenario number 4, the Original issue is at 1,050, which is a premium; since it is an issue which is in demand. the Bond redeemed is at 1,000, which is par and the investor loses 50 which pulls down the overall yield from making an investment.

In all scenarios it has to be noted that the coupon is paid on the face value of the bond.

2 Ratings

2.1.1 Rating Agencies & Ratings

We will now look at Rating Agencies, Ratings. The impact of rating changes.The Data That Reflects The Stability Of Ratings Done By An Agency.

Rating agencies are Independent professional firms that conduct in-depth research on companies and papers issued by them. The top names are:

- Standard and poor's
- Moody's
- And Fitch Ratings

Ratings improve the flow of information between borrowers and lenders. How so? A lot of information has to be shared by the borrower with the Rating Agency. That information is captured in the eventual rating assigned by the Agency. In effect, one symbol (AAA for example) gives an investor an instant 'feel" for the paper.AND YET: Ratings are only GUIDANCE: and do not replace any person's own research and analysis.

Ratings are done for the company (which is the issuer) for the issue. And are for two categories – long term and short term. Even if there is no issue an issuer can be rated – it indicates standing and strength.

Issue rating reflects the standard of THE particular bond issue. Two issues by the same issuer can have different ratings, depending on the income supporting the repayment.
For instance a bond in which "All payments from Google will go to pay the holders of this bond." Such a condition can give that bond a higher rating on the assumption that Google will keep buying; and paying.

Long term ratings are an opinion on whether a company or bond can pay its obligations over the LONG term? Short term ratings are an opinion on whether a company or bond can pay its obligations over the short term?

A good rating here is easier to achieve than the longer term rating.

Many institutional investors invest only in "investment grade" paper. The junk grade paper are out of bounds for them. Investment grade implies the paper/ Issuer should be rated in these scores between AAA to BBB.

The reliability and stability of ratings. This is a backward looking exercise, i.e. it is based on past data. The agency maintains data on what happens to the Bond afterward
"I originally rated it as an 'A'". It does BETTER than the initial analysis suggested. Let us say it gets Upgraded to AAA. It does WORSE than the initial analysis suggested. Let us say it gets Downgraded to BBB. If it is upgraded, the price will spike up: leading to profits for holders
If it is downgraded, the price will drop: leading to losses for holders.
The agency publishes a TRANSITION MATRIX: the data which shows how ratings performed over time and percentage of upgrades and downgrades which is even more useful to the informed investor.

2.2 Convertibles

Let Us Understand, What is a Convertible Bond? The Issuer's Motivations in a Convertible. The Investor's Motivations in a Convertible. These Aspects Through An Example.

A Bond normally has a life beyond 10 years. At a point in time, the Convertible BOND is converted to an Equity Share. As a Bond it pays Coupon. It will be repaid before others in event of insolvency. Once it becomes equity it no longer needs to be repaid. How many Shares will the investor get for every Bond held?

That rate is previously agreed.The conversion may or may not happen, depending on who has the right on the conversion date; and whether investors might be more willing to give loans to a company in its early stages as compared to taking the risk of putting equity into the venture only to see it fail.

Investors that funded the company with debt may be happy to own shares once it is established as a successful company.
The company prefers this because it does not have to pay out cash to repay debt in a growth phase.

Look at this example. It helps us understand a number of terms as also the structure of a convertible. The data on the left is typically what will be available from a data terminal such as Bloomberg or reuters. The Bloomberg ticker code (PTRL 3.75 09/10) at the bottom when punched into a Bloomberg terminal will call up the issue details. Anyone can check the details without actually accessing any paper.

The Nominal Value, $ 1,000 is the Value on which Coupon is payable. Market Price at Issue indicates the issue price: 100 indicates full value (no discount or premium to Nominal Value at issue). The Coupon at 3.75% when applied on then nominal value gives : dollar value interest payable on the Bond. The Conversion Ratio is given: each bond converts to 107.2570 shares at anytime before maturity. It implies a conversion price: Bonds worth US$ 1000 will fetch 107.2570 shares which works out to $ 9.3234 per share.

2.3 Calls and Puts

Let us look at How Call Options Work in a Bond. How put Options Work in a Bond. How Convertibility and Call/Put can be combined.

2.3.1 Call and Put Features

The Call is the Bond Issuer's right to call back the bond. In other words, it is the issuers call to repay it early. This must be included as in the terms and conditions at the time of issue to apply

Example: A Financial Institution issued a Bond with the marketing tag line: "make your child a millionaire 18". It was a deep discount bond offering 18% rate of interest p.a. Subsequently, interest rates came down to 6 to 8% p.a.
The institution invoked the call option and repaid this high cost borrowing.

The Put is the Bond holder's right to give back or put back the bond. In other words, The holder asks for early repayment. This must be included as in the terms and conditions at the time of issue to apply. Sometimes these are referred as 'embedded options' simply because they need to be pre-included in the T&C at time of issue. These options are also associated with a 'window' during which they can be exercised.

- Impact Of Embedded Calls

  Remember that The price of money is: INTEREST RATE. If the interest on the bond is higher than the market rate, The Issuer will exercise the Call and get the bond back, repaying it. This helps it save interest that it pays, which is right now HIGHER THAN the Market Rate of Interest. If the interest on the bond is lower than the market rate, The Issuer will NOT exercise the Call and continue enjoying the benefit of 'lower than market interest rates'.There is an exercise WINDOW in which the Issuer can exercise the call. This comparison of the interest rate on the bond with the market is at that window. So, the ability to use the CALL depends on rates during the window.

- Impact Of Embedded Puts
  If the interest on the bond is LOWER than the market rate. The Holder will exercise the PUT and give up the bond, asking for money back. This helps reinvest the money in the HIGHER RATE available in the market.

If the interest on the bond is HIGHER than the market rate, The Holder will NOT exercise the Put and continue enjoying the benefit of 'higher than market interest rates'.There is an exercise WINDOW in which the Issuer can exercise the call. This comparison of the interest rate on the bond with the market is at that window. So, the ability to use the CALL depends on rates during the window.

2.3.2 Some Combinations of Terms

A call option combined with a conversion clause has the effect of telling the holder Either accept conversion to equity; or the bond will be repaid.

The ISSUER is able to manage the borrowing costs.
If the Bond Holder prefers to hold the bond for its higher rates, the Issuer is able to force out the investor.

This is not suitable to the Investor. But at the time of the issue the Investor might not have visualized this scenario and preferred to invest.
A put option combined with a conversion clause has the effect of telling the ISSUER. Either the conversion is attractive; or if it not then repay "me".

The Bond Holder is able to manage the its earning. If the conversion is not profitable for the Holder it will prefer to give back the bond and get its money: invest it anew at higher rates prevailing 'today'.

This is not be suitable to the Issuer. But at the time of the issue it might not have visualized this scenario and preferred to raise money on these terms.

3 Trading Bonds

We now look at How Bonds are Quoted in Markets. Interest Payment Frequencies and Dates Closely. The Accrual of Interest. Clean & Dirty Prices in Bonds. The Use of Dirty Prices in Bond Settlements.

In The Market Place Bonds Are Quoted As Follows

THE BUYER IS AT 99.10 and the seller is at 99.20. These rates represent PERCENTAGE of the Face Value of the Bond.

If it is a bond of FV $ 1,000. This quotation is 99.1% of 1000, i.e. interested in buying at 991

If it is a bond of FV $ 1,000. This quotation is 99.2% of 1000, i.e. interested in buying at 992

FV: $ 1m? Buyer @991,000 FV $ 1m? Seller @ 992,000. The difference is the SPREAD

This price does not include any of the INTEREST aspect of a bond as we shall see. It is called the CLEAN PRICE. We say: Bonds are traded at the CLEAN PRICE

3.1.1 Interest (Coupons) in Bonds

Bonds, as we know, pay interest (coupon) periodically. There are a number of interest payment dates in the life of a bond. Let us take two dates and discuss how far apart they can be.

In Corporate Issues this is once in 6 months (this is by convention; but it could be quarterly, too. Conventions can be broken.) In Munis interest is paid once in 6 months
Government Securities – most governments of the world pay interest: once in 6 months

Eurobonds denominated in US Dollars pay interest annually, once in a year. Swiss and Swedish Government Bonds pay interest once a Year

- **Interest Accrual**
  Time is like a meter, running all the time: the bond earns interest as time ticks, whether payable or not. Interest is payable only on Payment Date. But it is earned continuously. Assume interest is earned at $ 1 per day, in 181 days $181 would accrue which will be paid out on the Payment Date. Then, here is how that would look: On day one, one dollar is earned. On day two another dollar is earned and the total interest due, or accrued is two dollars. On the third day another dollar is earned and the total accrued interest is 3 dollars. And so on till the day number 181 when the total interest earned, day by day is 181 dollars.

Then comes the next interest payment date and the total accrued interest is paid in Cash to the bondholder .The meter of accrued interest is reset to zero and from the next day the accrual starts again at one dollar a day

3.1.2 Accrual and The Traded Bond

When an investor sells a Bond it holds, the date could be any date on the calendar: particularly, between any two interest payment dates. Let us mark that as the trade date

Interest Accrued between these two dates belongs to the SELLER who was the owner of the bond till this day. But the Entire interest actually goes to the HOLDER on Payment Date # 2, i.e. the Buyer of the bond

So it is agreed in bond markets that the BUYER will hand over this accrued amount to the SELLER along with the Purchase Price at the time of the purchase.

The Purchase Price is also known as CLEAN PRICE. To the CLEAN PRICE ADD ACCRUED INTEREST to get DIRTY PRICE. When the Bond is traded, CLEAN PRICE is agreed.
When the Bond Trade is paid for (when the trade is settled) DIRTY PRICE is paid

- A Few Points on Clean & Dirty Prices
  - At ANY point in time, whether TRADED or not, the Market Value of a Bond is its Dirty Price
  - Find the last quoted price.
  - Work out the Accrued Interest on the date of valuation. Add the two.That is the Fair Value of the Bond, the cash value it will realise if it is sold immediately.
  - The market value of a bond is relevant for other transactions, especially where it is used as an asset for a repurchase transaction (repo)
  - Bonds are traded on Clean Price. Bond are settled at Dirty price
  - This is a market convention which need not be explicitly communicated.

3.2 Simple and Compound Interest

We Must Now Understand Simple Concepts of Principal, Interest, Tenor and Rate. The Oddity of Number of Days in a Year. Simple Interest. Compound Interest, Compounding & Future Value.

3.2.1 Interest In Financial Markets – Concepts

Interest is calculated on the principal loan given. Principal is the amount of the loan on which interest is to be calculated and paid .Interest is the percentage per annum. Always per annum, whether stated so or not.

5% is represented as 0.05. 10% is 0.10. And so on.The period for which interest is to be calculated. In a full year, the percentage per annum applies. Actual days for which interest

is to be paid. Actual days for which interest is to be paid. If the period is less than a year, then we need to work out the interest for the shorter period.

Days in a Period and Year. When the period is part of a year, interest is payable proportionally. Days in period have to be divided by days in the year

Days in a year: IS ALWAYS 360 for calculation purposes, in ALL international, most countries of the world including USA DAYS IN A YEAR ARE 365 ONLY in London

If interest is payable for 48 days , interest for the full year has to be proportionate as follows : 48 divided by days in the year as discussed above.

Simple Interest Implies

- The amount of interest does not earn any interest on itself.
- The principal earns interest
- The interest itself earns no further interest

Compound Interest Implies

- The principal earns interest
- The interest itself earns interest if it is not paid out.
- If earned interest is paid out, then there is no question of paying interest on interest, no question of compounding.

Simple Interest Is Calculated As Follows: Multiply the principal amount of the loan by the rate payable on the proportion of days.
Situation: "$ 100 is lent for one year @ 4% per annum. Applying the Simple Interest formula: The maturity value is $ 104

3.2.2 Simple Interest & Compound Interest

Situation: "$ 100 is lent for one year @ 4% per annum. Interest is compounded every 6 months." If 100 dollars is invested, in simple interest the maturity value is 104.

If interest is to be compounded, 100 dollars invested earns 2 dollars in 6 months. From the very next day, the 2 dollars also starts earning interest. The second half of the year earns interest of another two dollars. The compound interest earns 4 cents. The maturity value in one year is 104.04. The extra 4 cents earned is the effect of compounding.

If Compounding Was Every 3 Months: Situation: "$ 100 is lent for one year @ 4% per annum. Interest is compounded every 3 months." $ 1 earned till here in 3 months .From here, 4% p.a for 3 months to be paid on $ 101 .Total Interest Earned so far $ 1. $ 1.01 earned till here the next set of 3 months

Total Interest Earned so far $ 2.01. From here, 4% p.a for 3 months to be paid on $ 102.01. $ 1.0201 earned till here in the next set of 3 months. Total Interest Earned so far $ 3.0301 From here, 4% p.a for 3 months to be paid on $ 103.0301 by the last set of 3 months, that is the end of the year $ 1.030301 is earned. Total Interest Earned so far $ 4.060401.

So $100, @ 4% p.a with quarterly compounding results in Maturity Value $ 104.060401. Same amount & rate with 6 monthly compounding results in Maturity Value $ 104.04. Same amount and rate, in Simple interest results in Maturity Value $ 104.00

What Did We Learn? The more often you compound the more the sum builds up to Maturity Value $ 104.060401. Fewer compounding period gives a smaller sum Maturity Value $ 104.04 Simple interest gives lowest returns because interest does not earn interest. Maturity Value $ 104.00. ALSO: Don't be surprised at the large number of decimal places some of the calculations result in.

No rounding off should be done till one is ready to calculate the actual dollar value of the amounts to be paid. That is because what looks like a 6th or 8th decimal place amounts to a

good sum for large value transactions.For e.g. if the maturity value of 104.060401 was applied on $ 100 million, the amount to be paid would be $ 104,060,401.
No one in the world of finance would give up $ 401, much less $ 60,401.

- Compound Interest from a Formula:
  The Maturity Value can be got by adding the principal to the interest component and is captured in the formula below:

- Compounding Periods
  The formula for Maturity Value with Compound Interest: If interest is compounded 4 times in a year, Take t as equal to 4.Divide the interest rate in decimals by 4. If interest rate is 4% p.a. here is how it will look: If interest is compounded 2 times in a year, Take it as equal to 2. Divide the interest rate in decimals by 2. If interest rate is 4% p.a. here is how it will look: If interest is compounded 12 times in a year, Take it as equal to 12. Divide the interest rate in decimals by 12. If interest rate is 4% p.a. here is how it will look: This is also the formula used for FUTURE VALUE. It answers the same question: What will $ 100 become if invested for a number of years; and if compounded quarterly. Or semi-annually. Or monthly. Or annually.

3.3 Present Value and Future Value

Let Us Learn About Present Value. About Discounted Cash Flow. To Apply DCF In Bond Valuation About Deep Discount Bonds. Value of a Perpetuity.

3.3.1 Present Value

Imagine you can place a deposit with a bank which will pay you 10% interest per annum. In other words, if you invest $ 100 in that bank, it will become $ 110 in one year. If I promise you 100 a year from now, its the same as giving you 90.9 today.

You will put it in your bank @ 10% and get 100 a year from now. How did you get that?
$ 110 one year from now is the same as $100 today .Therefore $ 100 one year from now is?
The answer involves a simple cross multiplication

This formula gives the same result which is a transposition of the future value or compound interest formula.
What is the present value of $ 100 received a year from now At an interest rate of 10%?
Using the present value formula we get 90.9. This is also known as discounting a future cash flow to its present value. Or the Discounted Cash Flow Analysis

3.3.2 Discount Cash Flow

Discounted Cash Flow “brings forward” all cash flows to one common date (usually the present). Money is received at different times in the future. A year from now, two years from now or three years from now How much is it worth today? Today’s Value

We have to apply the present value formula, repeatedly, merely changing the number for time t. Assume, cash received is $ 100 each year and the rate is 10%The first year value is 90.9, the second year value is 82.64, the third year value is 75.13, as you can see, as the money arrives later and later, its value is lesser and lesser.

Totaling the three we get the number 248.67
That is the value of a promise to pay 100 every year for 3 years if the interest rate (discounting rate) is 10.

A bond is similarly just a series of promises to pay.

3.3.3 What does a Bond promise?

A Bond represents a loan given. The earning on a loan is the 'interest' / 'coupon' promised to the holder. At the end of the loan period (bond maturity) the loan must be repaid

All of these are future cash flows. We can discount the money receivable each year and value the bond.Cashflows associated with a bond are taken as assured. It is of course, dependent on the standing of the promiser. Those issues are not going to be discussed here, but remember this concept of 'assured cashflows' in comparison to cashflows associated with equity.

This is where looking at a deep discount bond helps clarify the mind. A Deep Discount Bond does not pay any coupons. The Investor directly gets a sum of money at maturity. There is only one single cashflow to discount. So the Value of a Deep Discount Bond is just the discounting of the final year cashflow

3.3.4 Pricing a Deep Discount Bond

A deep discount bond promises a maturity value. A company wishes to issue bonds that will mature at $ 1,000 in 20 years. Market rates for such an issuance are at 4%

Applying Discounting we can say that this bond can be issued today at 456.3869
Financing a Project with a Deep Discount Bond. To raise $ 456.3869;ISSUE One bond. To raise $ 10 m; ISSUE 21911 BONDS. At Maturity; Repay 21,911 bonds x $ 1000 per bond
THAT: is the future value of $ 10 million .Borrowed for 20 years @ 4%

3.3.5 Value of a Perpetuity

A Perpetuity is an amount every month or year, receivable forever. If the amount I am going to receive is the same and I am going to receive it forever, then: Value of the right IS THE CASHFLOW DIVIDED BY THE RATE

If I have to give you 100 forever, every year, I might as well give you a one time payment of 1000. You can invest in an investment yielding you 10%. Thereby, you will receive 100 for life: which is the amount promised.

3.4 Applying DCF to Bonds

We will now learn The Concept Of Yield To Maturity

Suppose We Know The Current Value Of The Bond Current market price. The traded price of a bond is market information available at data providers like Reuters and Bloomberg. The rest of the Cashflows are something which we have already understood

So far we have been using assumed rates of interest

In this exercise we realise that we know everything else. The only thing we do not know is the value of r. If CF (1 to n) are known, and P-o is also known This 'r' is called "Yield to maturity". YTM is a percentage return.

Data providers also supply YTM on a daily basis; as the price moves, YTM moves. It is one thing to know how these things are calculated. But it is also important to understand the implications of these numbers.

I may buy a bond which is realisable at 1000 at 98. The $20 gain accrues to me over the period from purchase of the bond to the maturity of the bond. This additional per annum yield adds to the annual yield to give us YTM; YTM is the yield to the holder of the bond if held to maturity. It is a factor of the price at which bond is purchased.

YTM varies for different holders of the same bond depending on when they buy it and the price at which they buy it. A bond was purchased for 950/-. It pays a coupon of 80/-.

At maturity, the bond will mature at 1000. The bondholder gains a sum of 50 in addition to the 80 he gets annually. Both benefits added together and annualized comprises the yield if the bond is held to maturity known as YTM. This "50" will be achieved only if held to maturity

- Two bonds have identical cashflows. One is purchased from the market at a premium. The other is purchased at a discount.Which will have a higher YTM?

  At maturity, the bond purchased at premium will be redeemed at Face Value which will cause a loss to the holder. This will pull down the YTM. The bond bought at a discount will yield a gain on maturity which will increase the YTM. Since all other cashflows are identical, the bond which results in gain at maturity will have a higher YTM.

- Two bonds are bought from the market: Bond A at premium; Bond B at discount. Both have the same YTM.Which offers a better cashflow in terms of coupons?

  Despite causing a loss on maturity, Bond A has the same YTM as Bond B. This means Bond A offers cashflows which are higher than Bond B and these make up for the losses of Bond A.

- Two bonds have the same YTM. Bond A has higher cashflow from coupon and Bond B has lesser cashflow from coupons.Which was bought at discount and which was bought at premium?

  Bond A has higher cashflows; but these are offset by losses at maturity. These means Bond A has been bought at a premium.

3.4.1 Market Price vs. Intrinsic Value

Market Price is what a Bond trades for; data seen in the markets and on the terminals or data feeds of data providers Intrinsic Value is what the bond is worth as seen in the mathematics of bonds and Discounted Cash Flow valuations
Do not be confused by the existence of both of these.Markets are cyclical. Sometimes, Markets overpay: Market Price is greater than Intrinsic Value. Sometimes, Markets underpay: Market Price is lesser than Intrinsic Value

That is what trades do for a living: try to figure out where Market is vis-à-vis Value and trade accordingly. This is no different from the play in Equity Markets

4 Coupons and Yields

We Now Examine Coupons & Yields. The Linkage between Market Rates of Interest and the price of bonds. The Price Yield Relationship

4.1.1 Coupon: Things To Remember

- This is the 'interest' that the issuer of paper promised the subscriber to the paper.
- It is a rate.
- This rate is applied on the 'Face Value' of the bond.
- This results in a dollar value of coupon receivable by the Holder.
- It has nothing to do with the market price of the paper itself.

The coupon is a flat 8%. Coupon is a Fixed amount; unaffected by traded price of the bond
The yield referred here is coupon yield: NOT YTM. An issuer can change Issue Price (in the column 'market value') and change the return an investor gets, without changing how much he pays! This is the return an investor earns by buying the bond at this price

4.1.2 Linkage between Market Rates of Interest & Bond Prices

Let's say you own a bond on which the coupon is 8% .In the market interest rates change to 12%. (there are various reasons this happens; discussed elsewhere). Suddenly what you hold is no longer attractive. You could earn 4% p.a. more if you had invested today, rather than back then when you bought the bond. You go into the market to sell the bond so you can reinvest in today's market (bonds) at 12% .But who will buy a bond that pays a 8% coupon when the market pays a 12% coupon on new bonds? The interest rate differentials are exaggerated for learning. They actually tend to be between 0.1 and 0.75% at most; rarely higher in the developed economies

The lack of interest in the 8% bond causes its price to drop. To what extent will the price drop? There are already a lot of things we know about the bond By buying the Bond at this price. The buyer should get a yield (Return on Investment) of so much. The Holder of the Bond who is selling at this price makes a loss.

Let's say you own a bond on which the coupon is 8% . In the market interest rates change to 6%. (there are various reasons this happens; discussed elsewhere). Suddenly what you hold is VERY attractive. People rush to buy what you hold. The demand for a 8% Bond in a market which pays only 6% is HUGE. To what extent will the price RISE? There are already a lot of things we know about the bond

By buying the Bond at this price, the buyer should get a yield (Return on Investment) of so much .The Holder of the Bond who is selling at this price makes a gain. In financial markets, there is no reward for doing what is obvious. Nobody can buy today and make yesterday's return. The trade has to be done in ANTICIPATION of a move.

- Bond A: Coupon is 10% and market price is 800. Bond B: Coupon is 12% and market price is 1200. Which offers higher yield?

  Where unstated, Face Value is 1000/-. 10% of 1000 = 100. Yield is 12.5% for Bond A. For Bond B it is 120 / 1200: 10%

- Bond A: Coupon is 10%. It is quoting at a yield of 8.33%. What market price does that imply?

  100 divided by 0.0833 = 1200. Bond A: Coupon is 10%.

- If you plan to sell the bond at a price higher than par, the yield on the bond will be higher than the Coupon or lower?

  Lower.

- Bond A: Coupon is 10%. If the bond is quoted in the market at below par rates then the yield will be higher or lower?

  Higher.

Summarizing that the Bond when it is Issued. Price is at parMarket Rates Rise. Bond Price falls to Discount. Bond Yield rises Above Coupon. Market Rates Drop. Bond Yield drops below Coupon. Bond Price rises into Premium. The Bond at Maturity. Returns to par. A Bond matures at its Face Value; why will anyone pay one cent more for it on that date; why will anyone accept one cent less on that date?

Interest Rate Risk is the risk that the market rates change, causing loss to the holder of an instrument.

- Bond prices are more likely to show movement when they are:
  a. Nearer their maturity date
  b. Further away from their maturity date

Further away from maturity date. At maturity the bond value will reach par. As maturity date nears and goes below one year, it is essentially a money market instrument in terms of maturity period left over.

- As a bond reaches maturity:
    a. Yield comes close to coupon
    b. Price comes close to par
    c. both
    d. neither

c. Both. Price comes closer to par and that results in yield coming close to coupon.

- Yield can be further away from coupon as the bond:
    a. Nears maturity
    b. is far away from maturity

Far away from maturity because that is when the price is likely to be far away from par.

- Coupon and Yield are:
    a. Directly proportional
    b. Inversely proportional
    c. Linked through market price
    d. Have no relationship

c. Linked through market price. The lower the price the higher the yield: it goes higher than coupon.

4.2 Maturity Duration Convexity

Adding Time to the Discussion. We will now explore Maturity. Weighted maturity. Duration. Convexity. Comparisons of these Concepts on the Sensitivity Scale. The Concept of Residual Maturity.

Factors That Impact Bond Prices
The extent of the reaction of prices to movements in market rates is based upon

- Underlying credit quality
- Underlying instrument quality
- Length of time to maturity

We will examine this last point in detail in this section

4.2.1 Maturity

In which of the two cases below is the investor at greater interest rate risk?
The holder of this instrument is stuck for a longer period of time with a lower rate than where the market is at, if the market rates go up. LESSON: Greater the maturity, greater the Interest Rate Risk

Which of the two cases below is the investor at greater interest rate risk?
Going by maturity, both bonds have identical re-pricing risks

4.2.2 Weighted Maturity

Considers the repayment pattern: what is the weighted maturity of the second bond?
Since some of the money is received halfway through, the money is available for reinvesting at higher market rates; the weighted average maturity is 15 years.

4.2.3 Duration

Examines the underlying cash flow associated with the bond
Every single interest payment puts money in the hands of the bondholder a little sooner. It improves the maturity profile of the bond; reduces risk.

- Maturity, Weighted Maturity, Duration:
  The greater the Maturity, The greater the Weighted Maturity, The greater the Duration. THE GREATER THE RISK.So far, Risk has been presented as a negative aspect.But, unless you are willing to run the risk, you cannot make profits either.

A Bond with HIGH Maturity / Weighted Maturity / Duration. Price will CRASH if the market interest rates rise. BUT: the prices will also RISE handsomely if the interest rates drop.

When Interest Rates Rise, Bond prices FALL. But the periodic coupon that is received is reinvested at these higher rates .This fall is offset by this gain, over the life of the bond.

Regardless of the price drop previously experienced, the bond matures at face value. (The outcome of Holding the bond to Maturity.) (Held to Maturity implies that the market movements are nullified over time.

When Interest Rates Fall, Bond prices Rise. But the periodic coupon that is received is reinvested at the new lower rates .This gain is offset by this loss. Over the life of the bond, so that at maturity, regardless of the price rise previously experienced, the bond matures at face value. (The HTM outcome.)

- Modified Duration
  MD is the point at which Change in bond price as a response to interest rate balances out the Reinvestment impact of changed rates.

- Convexity
  Interest Rates Change. Bond Prices Change in response. For the first few points of rate change, the response of bond prices is greater. As interest rates continue to change, the change in bond prices slows down. Duration as a number does not factor this in. Convexity captures this “change in speed”.
  We see this when we compare the Price Of Bond As Predicted By Duration with the , Actual Eventual Price Of Bond. The differential (error) is Convexity. If bond prices are calculated as a function of duration as well as Convexity you have a better predictor.

4.2.4 The Yield Curve and Convexity

The Basic Yield Price Line is shown as a downward sloping line. Yield Price Relationship In Duration Terms has a slightly curved line. The difference comes from using a rough measure as maturity in the simple line. Yield Price Relationship including Convexity gives line with more curvature. The gap is the Error from using duration only

The Relative Scale
- The broader coarser measures are to the left
- The Fine precise and accurate measures are to the right

4.2.5 The Actual Maturity Profile of an Instrument

The Original Maturity of an instrument may be 30 years. AFTER 29 years and 300 days. Only 60 days are left. This is called residual maturity
Originally, this Bond had a 30 year maturity profile with a volatile response to interest rate movements. The price movement of the instrument will be in line with its residual maturity. This BOND will behave like a MONEY MARKET INSTRUMENT

With a duration of 60 days: low price volatility, The Lesson: while working on bond portfolios, one should use the residual maturity for all analysis; not the original tenor.

4.3 Term Structure of Interest Rates

We Will Now Look At, What is meant by the yield curve. What is mean by term structure. And what shifting yield curves are

A Table of Interest Rates is Easily Understood. Every loan of a particular term, ranging from 1 day to any number of years, has a specific rate of interest in the market place.

- Convert It To a Chart
- Interest Rates go on the Vertical Axis
- Tenor goes on the Horizontal Axis
- Rates are arranged from Zero Upwards
- Time is arranged from Zero Onwards
- Plot The Rates Against The Tenor As Points In The Chart
- Plot The Rates Against The Tenor As Points In The Chart
- Draw A Line Through The Dots: You Have A Yield Curve
- This is Also called the Term Structure of Interest Rates

Rates Change Every Day, Every Minute. The rates that we plotted: were the rates on January 1, of a year .When the markets open on January 2 the rates will be different and the yield curve will be different. Similarly on every single day. This is called the Shifting Yield Curve. The Shifts Tell Us Where Short Term And Long Term Rates Are Headed. If the analysis looks backwards, it explains the PAST. If it is forward looking, it is an attempt at anticipating the future

To sum it up with some modifications which should not affect your understanding. Term structure of interest rates Is that set of rates (YTM) for a given risk-class of debt securities (for example, Government Bonds) at a given point in time.

When plotted on a graph, the line is called a Yield Curve. One important factor explaining the difference in interest rates of different securities is the Term or length of time before maturity. The relationship between the terms of securities and their market rates of interest is known as Term Structure of Interest Rates

We want to understand this because it helps us understand bond trading strategies.

4.4 Term Structure and Strategies

Let Us Look At The Interpretation of Term Structures Strategies that would be based on expected interest rate movements

4.4.1 Term Structure of Interest Rates

The shape of the yield curve is one of the many pointers to current market sentiment in respect of anticipated level of future interest rates.

- An upward sloping yield curve implies:
  The shape suggests higher rates for long term borrowing. The demand for money is greater in the longer term therefore the price of money (interest rate) is higher. Meanwhile, there is a good supply of money in the short term (good liquidity). All this indicates that the economy is in good shape and doing well.

- A downward sloping yield curve implies:

Short term rates are higher and Long Term rates are lower. There is NO supply of ST money; people prefer to hold on to their cash. This happens in times of uncertainty.

In the LT there is no demand for money; it reflects a poor investment climate and confidence. Overall the downward sloping yield curve indicates poor economic conditions. A flat sloping yield curve implies that the Market is happy with current rate levels; or is clueless about where rates are headed. It could also be an interim shape as the Yield Curve changes shape.

Theoretically, a humped yield curve indicates that in the short term rates are expected to rise; but will actually fall in the longer term.

A More realistic explanation is that this is an unusual date on which a specific event (like regulatory reserve requirements kicking in on that date) causing rates to spike – but then it settles down to normal levels.

Three theories are used to explain the shape of the term structure

- Liquidity preference theory
  Investors must be paid a "liquidity premium" to hold less liquid, long-term debt

- Expectations theory
  The long rate is the average of expected future short interest rates

- Market segmentation theory
  Distinct markets exist for securities of different maturities

Now to some strategies Markets Operate on Expectations. Let us say, Long Term Rates are Expected to Rise. What does it mean for prices? Bond Prices are Expected to FALL. What would be the Trading Strategy for an asset whose price is expected to fall?

Sell bonds in anticipation .What will be the Market Movement? If enough people do that, prices WILL fall. Long Term Rates are expected to RISE: why? Because of economic conditions indicate that market is likely to heat up; inflation is up; Because of expected Central Banker action. BUT expectations can fail! SUPPOSE: the Central Banker does nothing! Or Economic conditions go bad! All those who had sold on expectation of price drop will rush to buy back. The rush to buy will push the price UP. Previous sellers incur losses: to stop losing more they may "stop-loss" by buying back their position
The price reversal will exceed the original levels: because of failure of expectation!
If the Long Term Rates DO rise, Bond Prices WILL fall. Those who sold in anticipation will make money.

Let us look at the opposite scenario. Long Term Rates Expected to Fall. What does it mean for prices. Bond Prices are Expected to RISE. What would be the Trading Strategy for an asset whose price is expected to rise?

Buy Bonds In anticipation. What will be the Market Movement? If enough people do that, prices WILL RISE. Long Term Rates are expected to Fall: why? Because of the economy seems to be slowing. There is no demand. Rates look like falling. Because of expected Central Banker action.

BUT expectations fail! Central Banker does nothing! Or Economic conditions improve!
All those who had bought on expectation of price rise will rush to dump. The rush to dump will push the price DOWN. Those who bought previously will book losses: but they will STILL want to exit: stoploss. The price reversal will exceed the original levels: because of failure of expectation! On the other hand If the Long Term Rates DO fall, Bond Prices WILL rise.
Those who bought in anticipation will make money

4.5 Seniority

We Will Discuss Seniority Of Debt In The Event Of Liquidation. The Different Layers In Repayment Priority. Look at Preference Shares and Common Shares in the Context. How Liquidators Operate

Seniority Lays Down The Repayment Priority. In an Insolvency, Senior debt is paid FIRST. Subordinated debt is paid after senior, before equity. Equity, common shares, are paid last

Large Corporations Can Have Layers In Between, Too Senior Secured are Loans secured by specific property are paid first from the proceeds of that particular property. Senior unsecured are Loans that have general security and they are paid next. Amongst subordinated debt the Senior ranked amongst those are the paid first from subordinated loans

Junior ranked (or those without the word senior) amongst subordinated loans are paid last. Preference Shares Have Characteristics Of Debt, But Rank Low In The Seniority Schedule
These are paid before equity shareholders

The liquidator will sell assets secured towards a particular debt and use it to pay off that loan. All other assets will be sold and converted to cash. The cash will be paid in the order of this queue, proceeding from Senior first, all the way down to Equity.
At whichever point the cash runs out, the remaining holders in the queue will receive NOTHING. It can happen that the cash pays off one category of debts fully. And only SOME cash is leftover for the next category. Everyone in that category will receive only proportional share of the money. For instance: “All subordinated bond holders will receive 25 cents on the dollar.” (meaning 25% will be received.) Equity May receive nothing. That is the high-risk, high-reward nature of equity.

5 Risks in Fixed Income

From a risk analysis perspective the benefits and risks in owning Bonds. Coupon is earned as promised by the issuer. The Uncertainty related with this cash flow/ benefit is about the performance about the business and therefore the issuers ability to pay.

If market Rates rise higher than coupon; it results in the negative effects of interest rate risk: and the bond holder at disadvantage. There is a possibility of Gains in the price of the security. This is market driven and happens if the bond pays higher coupon than range to which the market has moved. Conversely, losses can happen if the bond pays lower coupon than where the market is at.

The bond contains a promise to repay principal. If the Borrower (Issuer) defaults. There could be a Loss of principal. This is Credit Risk. Credit risk can also result in gains and losses
This Happens if the bond is graded up or down from a previously held rating, which is an increased or decreased perception of credit risk of the issue.

So let us look at all that in a structured fashion

5.1.1 Interest Rate Risk

The risk of interest rates changing from what is contracted to a disadvantage
Reinvestment Risk
The risk to an investor that when the time comes to reinvest, the rates or earning are not as attractive.

5.1.2 Call Risk

The risk that the Issuer will call back the bond because its interest rate is high; to the detriment of the holder.

5.1.3 Refunding Risk

The risk to an issuer that when the time comes to take a new loan in the place of the old, the rates are not as attractive; it becomes costlier.

5.1.4 Credit Risk

The risk to an investor that the issuer fails to meet obligations to pay interest, repay principal on time.

5.1.5 Liquidity Risk

The risk from locking up money from long; and for the holder to not be able to get liquidity by trading the bond.

5.1.6 Exchange Risk

It applies if Issuer and Holders are operating in different currencies. The risk that a change in rates affects the costs / returns adversely.