NISM CERTIFICATION EXAMINATION WORK BOOK

XXII

Fixed Income Securities

NiSM NATIONAL INSTITUTE OF SECURITIES MARKETS
An Educational Initiative of SEBI

Workbook for
NISM-Series-XXII:
Fixed Income Securities
Certification Examination

National Institute of Securities Markets

www.nism.ac.in

This workbook has been developed to assist candidates in preparing for the National Institute of Securities Markets (NISM) Certification Examination for Fixed Income Securities (NISM-Series-XXII: Fixed Income Securities Certification Examination).

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Foreword

National Institute of Securities Markets (NISM) is a leading provider of high end professional education, certifications, training and research in financial markets. NISM engages in capacity building among stakeholders in the securities markets through professional education, financial literacy, enhancing governance standards and fostering policy research. NISM works closely with all financial sector regulators in the area of financial education.

NISM Certification programs aim to enhance the quality and standards of professionals employed in various segments of the financial services sector. NISM's School for Certification of Intermediaries (SCI) develops and conducts certification examinations and Continuing Professional Education (CPE) programs that aim to ensure that professionals meet the defined minimum common knowledge benchmark for various critical market functions.

NISM certification examinations and educational programs cater to different segments of intermediaries focusing on varied product lines and functional areas. NISM Certifications have established knowledge benchmarks for various market products and functions such as Equities, Mutual Funds, Derivatives, Compliance, Operations, Advisory and Research.

NISM certification examinations and training programs provide a structured learning plan and career path to students and job aspirants who wish to make a professional career in the securities markets. Till March 2021, NISM has issued more than 13 lakh certificates through its Certification Examinations and CPE Programs.

NISM supports candidates by providing lucid and focused workbooks that assist them in understanding the subject and preparing for NISM Examinations. NISM has designed this examination workbook to assist candidates appearing for the NISM-Series-XXII: Fixed Income Securities Certification Examination. This book covers all important topics related to Fixed Income Securities markets in India. These include the basics of Indian debt markets, classification of fixed income securities based on various criteria, pricing of bonds, yield measures, term structure of interest rates, risks associated with investing in Fixed Income Securities and measuring of interest rate risk. This book also covers the Money market, Government debt market and Corporate debt market in India. It will be immensely useful to all those who want to have a better understanding of Fixed Income Securities markets.

S.K. Mohanty
Director

Disclaimer

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While the NISM Certification examination will be largely based on material in this workbook, NISM does not guarantee that all questions in the examination will be from material covered herein.

About NISM Certifications

The School for Certification of Intermediaries (SCI) at NISM is engaged in developing and administering Certification Examinations and CPE Programs for professionals employed in various segments of the Indian securities markets. These Certifications and CPE Programs are being developed and administered by NISM as mandated under Securities and Exchange Board of India (Certification of Associated Persons in the Securities Markets) Regulations, 2007.

The skills, expertise and ethics of professionals in the securities markets are crucial in providing effective intermediation to investors and in increasing the investor confidence in market systems and processes. The School for Certification of Intermediaries (SCI) seeks to ensure that market intermediaries meet defined minimum common benchmark of required functional knowledge through Certification Examinations and Continuing Professional Education Programmes on Mutual Funds, Equities, Derivatives, Securities Operations, Compliance, Research Analysis, Investment Advice, Portfolio Management and many more.

Certification creates quality market professionals and catalyzes greater investor participation in the markets. Certification also provides structured career paths to students and job aspirants in the securities markets.

About the Workbook

This workbook has been developed to assist candidates in preparing for the National Institute of Securities Markets (NISM) Certification Examination for Fixed Income Securities. NISM-Series-XXII: Fixed Income Securities Certification Examination seeks to enhance the knowledge and proficiency in the Fixed Income Securities markets in India.

This book covers many important aspects of Fixed Income Securities Markets in India including the basics of Indian debt markets, types of fixed income securities, pricing of bonds, yield measures, term structure of interest rates and the risks associated with investing in Fixed Income Securities. This book also covers the Money Market, Government Debt Market and Corporate Debt Market in India.

Acknowledgement

This workbook has been developed jointly by the Certification Team of NISM and Dr. Golaka C Nath and reviewed by Dr. Kishore Rathi, NISM's Resource Persons.

NISM gratefully acknowledges the contribution of the Examination Committee for NISM-Series-XXII: Fixed Income Securities Certification Examination consisting of industry experts.

About the Certification Examination for Fixed Income Securities

The examination seeks to create a common minimum knowledge benchmark for all associated persons employed or engaged in the Fixed Income Securities markets in India.

NISM-Series-XXII: Fixed Income Securities Certification Examination is a voluntary examination and is open to all. It seeks to enhance the knowledge and proficiency in the Fixed Income Securities markets in India and aims to enhance the quality of services provided by the professional in this market.

Examination Objectives

This book covers all important topics related to Fixed Income Securities markets in India. These include the basics of Indian debt markets, types of fixed income securities, pricing of bonds, yield measures, term structure of interest rates, risks associated with investing in Fixed Income Securities as well as the Money market, Government debt market and Corporate debt market in India.

On successful completion of the examination, the candidate should:

- Know the basics of Indian debt markets and different terminologies used in debt markets.
- Understand the classification of fixed income securities based on various criteria such as issuer, maturity, coupon, currencies, embedded options, etc.
- Be aware of the risks associated with investing in fixed income securities.
- Know the pricing of bonds (including floating rate bond), price-yield relationship and price time path of a bond.
- Understand the sources of returns and the traditional yield measures
- Understand the term structure of interest rates and the relationship between spot and forward rates.
- Understand the concepts of measuring the interest rate risk (including the concepts of Duration, Modified Duration, Price value of basis point, Convexity measures, etc.)
- Know the Indian Money Market and understand various instruments available in the money market.
- Understand the Government Debt Market in India including the issuance mechanism, secondary market, clearing and settlement, valuation and key regulatory guidelines.
- Understand the Corporate Debt Market in India including the issuance mechanism, secondary market and key regulatory guidelines.

Assessment Structure

The examination consists of 85 multiple choice questions (70 questions of 1-mark each and 15 questions of 2-marks each), adding to a total of 100 marks. The assessment structure is as follows:

Multiple Choice Questions *[70 questions of 1-mark each]*	70 * 1 = 70 marks
Multiple Choice Questions *[15 questions of 2-marks each]*	15 * 2 = 30 marks

The examination should be completed in 2 hours. The passing score for the examination is 60 marks (i.e., 60%). There shall be negative marking of 25% of the marks assigned to the question for each wrong answer (i.e., the penalty due to negative marking will be -0.25 marks in case of a 1-mark question and -0.50 marks in case of a 2-marks question).

How to register and take the examination

To find out more and register for the examination please visit www.nism.ac.in

Contents

CHAPTER 1: OVERVIEW OF THE INDIAN DEBT MARKET

LEARNING OBJECTIVES:

After studying this chapter, you should know about:

- Role of the Debt Markets
- Importance of Debt Markets
- Bond Market Ecosystem
- Role of Regulators
- Role of Credit Rating Agencies
- Role of Monetary Policy in Debt Markets
- Evolution of Debt Markets
- Market Dynamics

Debt is a concept of "I owe You" in which the receiver of the favour is willing to return the favour with agreed rate of return for using the favour for the time period. In simple terms, Mr. A is borrowing some money "X" from Mr. B for 3 months with a promise to pay back "X+Δ". This "Δ" is calculated as a percentage or rate of return on the Principal X. For example, Δ = X * R% *3/12 where "R% is the annual rate of interest agreed to be paid for the use of Principal amount "X" by Mr. A. In this example, Mr. A is the "Borrower", Mr. B is the "Lender" and "R" is the agreed rate of interest expressed as percentage per annum and time period is "3/12" years (i.e., 3 months). To make the process formal and enforceable, Mr. A can give in writing a "Note" that he would return the borrowed Principal money "X" to Mr. B after 3 months with agreed rate of interest at R% per annum. Simply put, we can state that the "Note" given by Mr. A is treated as a "Debt instrument" or a tradable security (Mr. B can assign the same to someone against appropriate payment before 3 months, if he requires liquidity and wants to exit the transaction): Mr. A here is the Issuer, Mr. B is the Investor, R is the Yield or Rate of interest on the date of transaction for the borrowed time (here 3 months). The tradable instrument is called "Negotiable Instrument", as necessary stamp duty is also being paid to the concerned authorities at the time of issuance for ensuring the enforceability of the contract in the appropriate court of law. The tradability of the instrument increases liquidity in the market and provides an exit route to Mr. B. Here Mr. B, as investor, takes a default risk or credit risk on the promise made by the Issuer, Mr. A, in the Note. If the Note is tradable, it becomes a security with a maturity (the date by which Mr. A has promised to pay back the borrowed funds with promised rate of interest).

Debt refers to obligation of repayment of borrowing by a legal entity such as an individual, a corporate firm or a Government. Debt is raised by selling bonds, bills, and/or notes (also known as instruments) to creditors with a promise of repaying the principal amount and periodic returns or interest on the principal. Debt instruments generally have a fixed time

line. From accounting perspective, debt is an asset for the investor and is a liability for the borrower. Borrowing funds through the issue of debt instruments helps entities with large financing requirements, as a single creditor may not be able to provide such as large amount of money. Creditors may also prefer tradable debt instruments that can be sold to meet their own liquidity requirements as well as to manage the risk on their credit exposures. These instruments also provide an opportunity to investors with surplus liquidity to earn returns, leading to the evolution of the debt market.

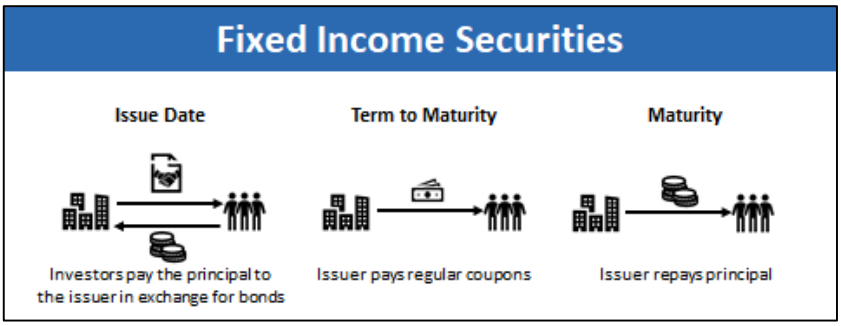
The debt market refers to the market where buyers and sellers trade in various debt instruments. The development of a vibrant debt market is essential for a country's economic progress as the debt market helps to reallocate resources from savers to investors.

1.1 Role of the Debt Market

Firms need finance for their day to day operations. Business owners raise finance mostly using debt and equity. "Debt" involves borrowed money to be repaid with interest, while "Equity" involves raising money by selling interest in the company. Debt is a charge on income for the firm, while the return on equity is an allocation / appropriation of profit made by the company. Similarly, governments also borrow so that they can finance spending for development of the society and country. Borrowing at both firm and government levels can be either to fund temporary liquidity shortfall or for funding long-term asset creation. Depending upon the duration and purpose of borrowing, a variety of debt instruments can be used for raising the funds. The debt market facilitates borrowing of funds using such instruments to investors having varied risk appetite.

Inherently, all debt instruments are essentially loans or IOUs, with an undertaking to pay or service regular promised coupon or interest and repay the principal amount borrowed after a specified period as promised at the time of borrowing. As the periodic interest or cash flows are typically fixed and known in advance, these instruments are more popularly referred to as "Fixed Income Securities".

Chart 1.1:



Borrowing money to finance the operations and growth of a business is a kind of leverage the company takes against its equity capital. This way, the owner does not have to give up (or dilute) control of the business, but too much debt can inhibit the growth of the company and many companies have gone bankrupt under the pressure of debt. Hence, a balanced decision on the level of leverage is imperative based on the careful assessment of pros and cons of the available financing avenues.

Advantages of Debt Compared to Equity

- Debt is a long term source of capital for borrowers.
- Borrowing through a debt paper by the owner would not reduce the control of the company for the borrower. Lender of funds will have priority over equity holders, only in case of bankruptcy of the company.
- The lender would get the promised interest rate as per the indenture of the issue as well as the principal at the time of maturity. The lenders are indifferent to the profit made by the company that is shared as dividend to the equity holders.
- In case of debt, the future obligations are mostly known to the company for making the cash flow planning and repayment planning. Hence, a proper and efficient cash flow management is key to the success of debt management.
- Interest or the coupon to be paid on debt is tax-deductible to the company as it is an expense for the company. This tax deductibility reduces weighted average cost of capital for the company. Higher the marginal tax rate of the company, larger is the benefit of such tax savings.
- Raising large amount of debt capital through private placement is generally less complicated as it is sold to qualified institutional buyers and unlike public issuances of equity, complex regulations may be avoided.
- For its debt obligations, the company is not required to send periodic mailings to large numbers of investors, hold periodic meetings of shareholders, or seek the vote of shareholders before taking certain actions.
- Debt is long term and lenders tend to be more committed than the equity holders.
- In the long-run, debt is cheaper than equity. The return on investment for equity holders is eventually higher than the interest paid on debt financing.

Disadvantages of Debt Compared to Equity

- Certain debt instruments may put restrictions on the company's core activities, and at times, exclusivity clauses can harm the company in general.
- Unlike equity, debt must be repaid at some point in time resulting in liquidity outflow.
- Debt repayment causes cash flow risk for the company and at times the company may not be able to refinance debt or raise money from the market to repay the existing debt, if the market condition turns bad.

- Debt is a leverage action and high leverage can jeopardize the growth plans of the companies. High leverage may also increase the risk of default. Historically, many good companies have gone into bankruptcy due to the burden of huge debt.
- Debt obligations are fixed at the beginning of the issuance with future dates known to both issuers and lenders. These obligations have to be repaid irrespective of the market conditions.
- If repayment of debt is not properly planned, the company's usual operations may get jeopardized because of such debt repayment obligations. At times, unplanned cash flow causes upheave in working capital finance, jeopardizing production plan and operations of the company.
- The larger a company's debt-equity ratio, the more risky is the company considered by lenders and investors. Accordingly, there is a limit to the level of debt a business can take in its balance sheet.
- Some form of debt like secured debentures require the company to create a lien on the assets of the company or create sinking fund out of operational cash flows which may be burdensome at times, specifically at the time of market stress.

1.2 Importance of Debt Markets

In any economy, the Government generally issues the largest amount of debt to fund its expenditure. A well-developed debt market helps the Government to raise debt at a reasonable cost. A liquid debt market lowers the borrowing cost for all and it provides greater pricing efficiency. Debt is funded either by bank loans or by bond issuances. A corporate bond market dealing with issuance of pure corporate paper helps an economic entity to raise funds at cheaper cost. The debt market brings together large number of buyers and sellers to price the debt instruments efficiently. A well-developed debt market reduces degree of banking support for the economy, as risk is distributed among many investors. A well-developed debt market helps the banking system with better Asset-Liability Management. The development of a well-functioning debt market helps to channelize the collective investment schemes to invest in the market and also facilitate in bringing retail investors to invest directly in debt. The well developed and liquid debt market also helps various long term investors like pension funds, insurance companies which have different investment objectives, as they invest for very long term, to match and immunize their liabilities.

The primary debt market helps Governments and corporates to directly sell their securities to investors. Typically, Governments issue debt through "Auctions" while corporates issue debt papers through "Private Placement". The secondary debt market provides an exit route to the investors and it also provides important information on price discovery process through credit risk appetite, spread, default probability, etc. The tradability of bonds issued by a borrower helps the market in getting required information on the firm.

However, in practice, issuance of debt is a multi-level process adhering to various regulations. It involves underwriting, credit rating, listing with stock exchanges, coordinating with issue managers to distribute to the right investors, liquidity in the market, banking support, etc. A well-functioning debt market would require developed and sustainable legal framework with clear bankruptcy codes. The regulatory cost of the debt can be at times prohibitive for smaller borrowers. Hence, small and medium firms usually prefer bank borrowing vis-a-vis debt issuances.

1.3 The Bond Market Ecosystem

The debt market deals in both Government as well non-Government debt instruments. The market has three important functionaries: (a) issuers like Government and Corporate firms; (b) intermediaries like merchant bankers and brokers selling debt; and (c) investors like commercial banks, collective investment schemes like mutual funds, pension funds, insurance companies, retail investors, etc. Typically, a firm wishing to float/issue debt instruments, for raising funds for its business requirements, contacts an intermediary like an investment banker or a merchant banker who helps the firm in selling the debt papers to qualified institutional buyers or High Net-worth Individuals (HNI). Before issuing a debt instrument, the issuer approaches a Credit Rating Agency (CRA) that vets the relative riskiness of the payments promised by the issuer. A debt instrument with a higher rating attracts lower interest rates, as it indicates relatively lower risk. All investors who failed to get the instruments in the primary market can purchase those securities from the secondary market. Thus, the three critical participants in the debt market are:

1. Issuers are Governments, commercial banks, public sector companies, private corporate firms, etc.
2. Intermediaries are investment banks and merchant banks who help issuers to sell bonds to the investors.
3. Investors are the private corporate treasuries, collective investment vehicles like mutual funds, insurance companies, commercial banks, pension funds, high net-worth Individuals, etc. Investors can further be classified as domestic and international investors.

In India, public issuance of a debt instrument has to go through elaborate vetting process as laid down by the Securities and Exchange Board of India (SEBI). Listing of a debt instrument in a recognized Stock Exchange and dematerialization of the instrument are important functions to be carried out by the issuing company or by the issue manager appointed by the issuing company. Rating agencies play a key role in summarizing information about the company issuing debt and this rating information is a key element for the investors, helping them in both the primary and secondary market transactions. The regulators ensure orderly development of the market with fair and transparent practices to protect investors. The

Reserve Bank of India (RBI) and the Securities and Exchange Board of India (SEBI) are the main regulators in the Indian debt market.

Chart 1.2:

Structure of the Indian Debt Market			
Market Segment	Issuers	Instruments	Investors
Sovereign Issuers	Central Government	Treasury Bills (T-bills) Cash Management Bills (CMBs) Dated G-Secs • Fixed Rate Bonds • Floating Rate Bonds (FRB) • Zero Coupon Bonds (ZCBs) • Capital Indexed Bonds • Inflation Indexed Bonds (IIBs) • Bonds with Call/Put Options • Special Securities • Separate Trading of Registered Interest and Principal of Securities or STRIPS • Sovereign Gold Bond (SGB) • Savings (Taxable) Bonds	Commercial Banks Financial Institutions Insurance Companies Co-operative Banks Investment Institutions Corporates Non-Banking Finance Companies (NBFCs) Mutual Funds Pension Funds and Trusts Governments Foreign Institutional Investors (FIIs) Foreign Portfolio Investors (FPIs) High Net-Worth Individuals (HNIs) Retail Investors RBI (in G-Secs)
	State Governments & Union Territories	State Development Loans (SDLs) Uday Bonds	
Public Sector	Government Agencies & State Bodies	Government Guaranteed Bonds/Debentures	
	PSUs	PSU Bonds, Debentures, Commercial Papers (CPs)	
	Commercial Banks Financial Institutions	Commercial Deposits (CDs), Bonds	
Private Sector	Private Banks	Commercial Deposits (CDs), Bonds, Perpetual Bonds, Credit Default Swaps (CDS)	
	Corporates	Bonds/Debentures Commercial Papers Floating Rate Notes Deposits Zero Coupon Bonds etc	

Indian Debt market typically has three distinct segments – (a) Government debt, known as "G-sec" market with Government of India issuing dated papers, Treasury Bills and State governments issuing State Development Loans of various maturities; (b) Public sector units (PSU) and Banks issuing instruments to raise resources from the market; and (c) private sector raising resources through issuance of debt papers. Government of India also issues Floating Rate Bonds, Inflation Indexed Bonds, Special Securities, and Cash Management Bills while State Governments raise funds using UDAY Bonds. PSU Bonds are popular among investors because of their perceived low risk and Commercial Banks issue short term papers like Certificate of Deposits (CDs) as well as long term bonds to fund their various business needs. The private corporates issue instruments like Bonds, Debentures, Commercial Papers (CPs), Floating Rate Notes (FRNs), Zero Coupon Bonds (ZCBs), etc.

1.4 Role of Regulators

Reserve Bank India (RBI) manages the borrowing of the Central and State Governments including the Union Territories. The RBI also acts as the regulator for the Money market and the G-Sec market. The RBI also governs instruments issued by Commercial Banks and other Institutions regulated by it. The RBI Act, 1934, Government Securities Act, 2006, Payment & Settlement Systems Act, 2007, Foreign Exchange Management Act, 1999, Banking

Regulation Act, 2017, etc. are the major regulations used by RBI to ensure an efficient debt market for Government securities.

The Securities and Exchange Board of India (SEBI) is the regulator for the corporate bond market including instruments issued by Commercial Banks and PSUs, provided such issuances by the above regulated entities are of more than one year of maturity. The role of SEBI is paramount when the funds are raised through public issuance. As per the guidelines issued by SEBI, the issuers are required to fully disclose the risks to the investors. For this, the regulator has implemented elaborate risk disclosure standards. Institutional investors like Foreign Portfolio Investors and Mutual Funds also adhere to SEBI guidelines while investing in the market. SEBI also frames guidelines for Debenture Trustees, Credit Rating agencies, Merchant Bankers, etc. to enable a smooth and well-functioning debt market.

1.5 Role of Credit Rating Agencies

Credit risk is the risk of default on a debt that arises from the borrower failing to make required payments. Sovereign domestic currency based debt instruments are regarded as safe sovereign investment and perceived to be “credit risk free”. Pricing and returns for non-government debt instruments are dictated by their issuers’ creditworthiness i.e., the continuing ability of the issuer / borrower to service the debt payments. Any deterioration in financial capability of the borrowing firm may result in delinquency, either in part or in full. Debt investments are generally long term investments and are illiquid. Hence, investors must have full information about the issuer as well as the issue, through regulatory and voluntary disclosures. The voluminous information about the issuer as well as the issue are required to be standardized and summarized through a well-qualified and unbiased agency that can provide the independent view about the possible future performance of the debt. This particular role of providing risk information about the possible future performance of the issue is typically performed by a Credit Rating Agency in the debt market. As per the extant SEBI regulations in force in the capital markets, it is necessary for an issuer to obtain a rating from any of the major credit rating agencies. In India, the Rating Agencies are regulated by SEBI under SEBI (Credit Rating Agencies) Regulations, 1999.

A Credit Rating Agency (CRA) is a company that provides information about the riskiness of a debt instrument or a company in terms of its promised performance of a debt instrument. They are regulated by SEBI and have to follow governance standards while giving the Rating on a debt instrument. They issue letter grades to instruments: “AAA” for highest safety, “D” for a Default and many other grades in between. The CRAs may rate government and corporate bonds, CDs, CPs, municipal bonds, preferred stock, mortgage-backed securities and collateralized debt obligations, etc. Investors typically see the rating before they invest in a debt instrument.

Credit rating started in 1909 in the USA with Moody's rating of corporate and railroad bonds as these bonds promised future performance. In the current times, credit rating has become an integral part of debt market around the globe. Credit Rating and Investor Services of India Ltd (CRISIL) started functioning in India in 1988 to rate corporate papers. SEBI mandates disclosure of at least one Credit Rating while issuing debt instrument. The credit rating represents a CRA's evaluation of the qualitative and quantitative information pertaining to the prospective debtor, including information provided by the prospective debtor and other non-public information obtained by the credit rating agency's analysts.

Ratings are the probability of default on repayment of principal or interest on relative scale i.e., an issuer's likelihood to default and its likelihood to default compared to another similar issuer. Ratings assigned by the rating agencies are taken as a key indicator of the relative riskiness of the bonds and to determine the credit spread to be charged for these instruments. It must be noted that the CRAs always qualify the rating provided for an entity or instrument and encourage investors to look for other possible publicly available information on the companies along with the Rating information. Often bonds are rated by more than one rating agency but the issuer is not bound to publish all the ratings.

For ease of understanding by investors, CRAs generally assign letter grades for their view of the instruments. The highest quality (safest, lower yielding) bonds are commonly referred to as "AAA", while the least creditworthy are termed as "junk".

Common Scale of Ratings:

- AAA to BBB-: Investment Grade
- BB+ to CCC-: Non-investment or Junk Grade
- D: Default Rating
- Short term Scale: A1+ to D

Ratings may also be issued for an issuer or a country's sovereign. Issuer rating is called Issuer Default Rating (IDR) which refers to the probability of issuer defaulting.

Advantages of Credit Rating:

- The CRAs are provided with the bulk of information by the issuer and they take into account the private as well as pubic information about the Company and its management along with its financial position to give a simplified riskiness rating. CRAs take complex data and general information and transform the same into an easily understandable form for the investor. The rating information is available to the investors freely on the website of the rating agency, if the rating is accepted by the issuer. For the investor, seeking such information from the websites of Rating Agencies is costless.

- Credit Rating provides relative riskiness of the instrument in clear form and also guides the market about any rating downgrade or upgrade at regular intervals. A consolidated history of rating migration of corporate entities may be used for understanding the possible probability of default level in the country vis-a-vis other countries.
- Rated instruments can be compared across global markets and the global investors can easily understand and interpret the risk of investment in a debt instrument.
- Credit rating agencies are independent institutions and their opinion on riskiness of an instrument is important for investors. However, as the issuers pay for the ratings, an inherent conflict of interest is built into the system.
- Credit rating also helps companies to improve their own image. A company with many high rated instruments would be regarded as a preferred investment destination by many investors, including the collective investment schemes like Mutual Funds.
- Credit rating aids investors in decision making choices between comparative investments with regards to: risk identification, issuer credibility, independent opinion and view about the potential risk, wider choice, saving in time and resources for understanding riskiness of the instrument and benefits of intensive surveillance by the rating agency.
- Credit rating is also beneficial to the issuing company, as rated instruments make it: easy to sell debt, lowers cost of borrowing, opens up a wider market, facilitates image building for the company and are particularly beneficial to new and unknown corporate firms.

For corporate bonds, default risk gauges the possible capacity of the bond issuers to make payment of the contractual interest and principal on agreed dates. Default Risk is the qualitative representation by the credit rating of the issue and the possibility of default increases, if the rating is downgraded by the rating agency during the life of the instrument. It is quantified as Probability of Default (PD) associated with the bond rating category. PD is measured using historical, annual default rates of bonds in different rating categories. Rating Migration is the possible change of rating (both upgrade and downgrade) of an instrument before its maturity. From the Table below, we can interpret that 87.19% of companies retained their “AAA” rating while 8.69% of Companies that were rated “AAA” were downgraded to “AA” and 3.37% of the said AAA rated companies did not seek Rating continuation after one year. The diagonal of the Migration matrix is very important to understand the relative riskiness of a market vis-à-vis other global markets. More percentage of companies retaining their original rating or showing improvement of rating (leftward move) is an indication of stability of the market.

Chart 1.3:

	One year Transition Rate								
					T+1				
	From/ To	AAA	AA	A	BBB	BB	B	CCC	D	NR
	AAA	87.19%	8.69%	0.54%	0.05%	0.08%	0.03%	0.05%	0.00%	3.37%
	AA	0.56%	86.32%	8.30%	0.54%	0.06%	0.08%	0.02%	0.02%	4.10%
	A	0.04%	1.91%	87.27%	5.44%	0.38%	0.16%	0.02%	0.08%	4.70%
T	BBB	0.01%	0.12%	3.64%	84.87%	3.91%	0.64%	0.15%	0.24%	6.42%
	BB	0.02%	0.04%	0.16%	5.24%	75.87%	7.19%	0.75%	0.90%	9.83%
	B	0.00%	0.04%	0.13%	0.22%	5.57%	73.42%	4.42%	4.48%	11.72%
	CCC	0.00%	0.00%	0.17%	0.26%	0.78%	13.67%	43.93%	26.82%	14.37%
	D	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	

A credit rating downgrade of the bond issuer impacts the spread over the risk-free yield curve at which the corporate bond is valued and thus translates into potential mark-to-market losses on a long bond position. A credit rating upgrade can similarly lead to potential mark-to-market losses on a short bond position. Rating Migration Risk is quantified by Rating Transition Probabilities released by CRAs. Each CRA has its own methodology for these matrices which are used for valuation of the instruments. Accurate and reliable default and transition/migration rates are important for all debt-market participants as they are critical inputs for valuation and pricing of debt instruments and loan exposures. They allow investors and lenders to quantify credit risk in their debt exposures and decide on the pricing. These are also critical inputs for credit risk assessment models.

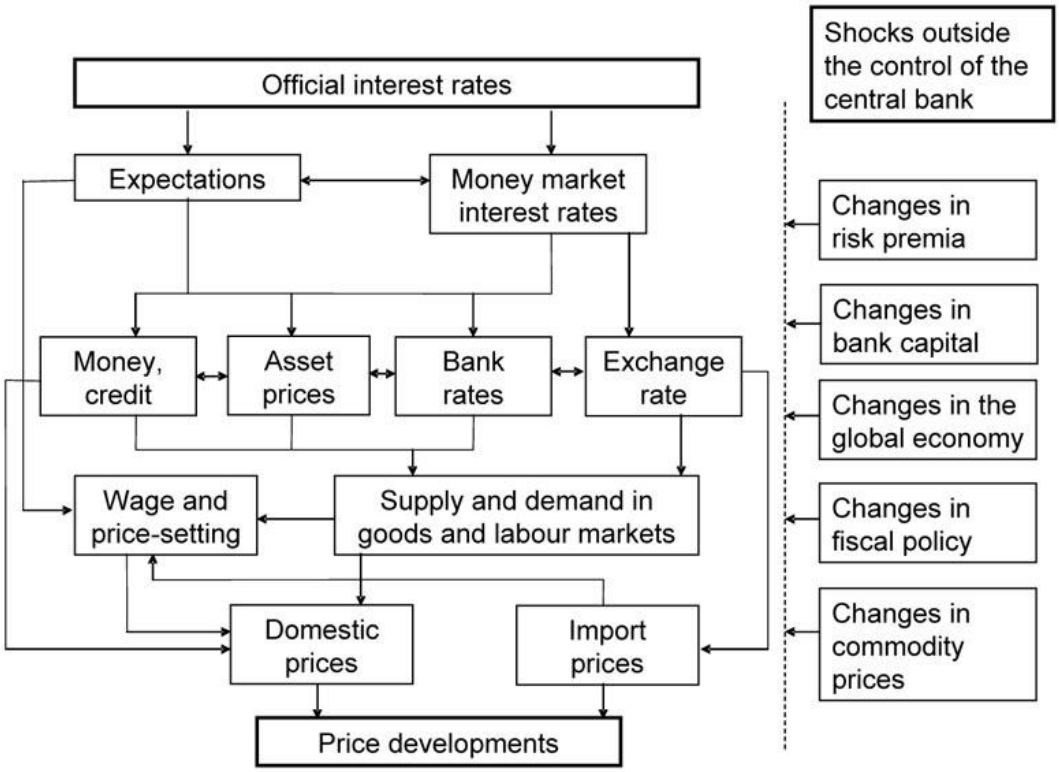
The top global CRAs are Moody's, Standard and Poor's (S&P) and Fitch Ratings. Some of the prominent CRAs in India are:

a) The Credit Rating Information Services of India Ltd. (CRISIL)
b) ICRA Ltd.
c) Credit Analysis & Research Ltd. (CARE)
d) Fitch Ratings India Pvt. Ltd.
e) Brickwork Ratings India Pvt. Ltd.
f) Acuite Ratings & Research Ltd.
g) Infomerics Valuation and Rating Pvt. Ltd. (IVRPL)

1.6 Role of Monetary Policy in Debt Markets

The effect of monetary policy can be best understood using the policy transmission chart:

Chart 1.4:



Bond yields are significantly affected by the central bank's monetary policy. Monetary policy at its core is about determining interest rates. Any change in policy rate affects the banks immediately as they have to borrow from and lend funds to RBI at the policy rates on a daily basis through Repo and Reverse Repo rates. The new rates are passed on to the customers using a spread mechanism. The process is commonly known as "Monetary Policy Transmission". In turn, sovereign interest rates define the risk-free rate of return. The risk-free rate of return has a large impact on the price of (thereby the demand for) all types of financial securities, including bonds. Central banks can influence the direction of asset prices through monetary policy. The central bank may use various monetary policy instruments (both direct and indirect ones) to engineer directional swings in the economy, if the central bank thinks that the changed direction may be beneficial for the society at large. During recessionary period, the central bank tends to lower interest rates to pump prime the economy by inducing higher demand which ultimately may lead to increases in asset prices. By lowering interest rates, the central bank ensures lower cost of borrowing to the corporate sector to foster growth. When the asset prices reach bubble stage, central banks may raise interest rate to downsize the effective demand to moderate the asset prices. Economic Boom and bust cycles are well managed by monetary policy effectiveness.

The Reserve Bank of India (RBI) is vested with the responsibility of conducting monetary policy in India. This responsibility is explicitly mandated under the Reserve Bank of India Act, 1934. The Monetary Policy Committee (MPC) constituted by the Central Government under Section 45ZB determines the policy interest rate required to achieve the inflation target.

The MPC has 6 members and is chaired by the Governor of RBI. RBI's Monetary Policy Department (MPD) assists the MPC in formulating the monetary policy. RBI has also set up internal Financial Market Committee (FMC) to monitor the liquidity situation in the financial system, specifically in the Banking system. The FMC of the RBI meets regularly to review the liquidity conditions in the market so as to ensure that the operating target of monetary policy is kept close to the policy repo rate. Monetary policy target rate is the inter-bank call rate because the stable call market rate ensures availability of adequate liquidity to banks at a reasonable rate reflective of the market condition for most secured borrowers like Banks. Any substantial change in the call market rate (either very high rate or very low rate compared to the RBI policy Repo rate) for a longer period brings the monetary policy into focus.

The primary objective of monetary policy is to maintain price stability while maintaining required level of growth to support employment and income of the population at large. In May 2016, the Reserve Bank of India (RBI) Act, 1934 was amended to provide a statutory basis for the implementation of the flexible inflation targeting framework. The Central Government has notified in the Official Gazette that 4 per cent Consumer Price Index (CPI) inflation as the target for the period from August 5, 2016 to March 31, 2021 with the upper tolerance limit of 6 per cent and the lower tolerance limit of 2 per cent. This would be the target for the RBI to foster its policy framework. The Central Government notified the following as factors that constitute failure to achieve the inflation target: (a) the average inflation is more than the upper tolerance level of the inflation target for any three consecutive quarters; or (b) the average inflation is less than the lower tolerance level for any three consecutive quarters. Prior to the amendment in the RBI Act in May 2016, the flexible inflation targeting framework was governed by an Agreement on Monetary Policy Framework between the Government and RBI.

The RBI Act has an explicit provision for the RBI to operate the monetary policy framework of the country to sustain growth and maintain price stability. The policy framework generally aims at fixing policy Repo rate based on the current and evolving macroeconomic situation in the country as well as global position, liquidity condition in the economy, asset price levels, foreign exchange positions, etc. The RBI also fixes Reverse repo rate as well as Marginal Standing Facility (MSF) rates linking the said rates to an interest rate corridor. Repo rate changes are transmitted through supply of funds or absorption of funds through commercial banks and RBI linkage window called Liquidity Adjustment Facility (LAF). Once the Repo rate is fixed by RBI, the operating framework designed by the Reserve Bank

envisages liquidity management on a day-to-day basis through lending and borrowing actions of the RBI using commercial banking channel that will have an influence on the operating target – the weighted average call rate (WACR) which is supposed to move around the Repo rate depending on the excess or shortage of liquidity in the market. The operating framework is fine-tuned and revised on regular basis for consistency with the monetary policy stance. The liquidity management framework was last revised significantly in February 2020.

There are several direct and indirect ways that are used for implementing monetary policy:

- Repo Rate: This is the policy rate. It is a fixed interest rate using which RBI lends funds to banks against approved securities under the liquidity adjustment facility (LAF).
- Reverse Repo Rate: It is a fixed interest rate using which RBI borrows funds from banks against approved securities under the liquidity adjustment facility (LAF).
- Liquidity Adjustment Facility (LAF): The LAF consists of overnight as well as term repo auctions. Progressively, RBI has increased the proportion of liquidity injected under variable Repo and reduced the availability of support through fixed rate channel. The aim of term repo is to help develop the inter-bank term money market, which in turn can set market based benchmarks for pricing of loans and deposits, and thereby improve transmission of monetary policy. RBI also conducts variable interest rate reverse repo auctions, as necessitated by the market conditions.
- Marginal Standing Facility (MSF): A facility under which scheduled commercial banks can borrow additional amount of overnight money from RBI by dipping into their Statutory Liquidity Ratio (SLR) portfolio up to a limit at a penal rate of interest. This provides a safety valve against unanticipated liquidity shocks to the banking system.
- Corridor: The MSF rate and reverse repo rate determine the corridor for the daily movement in the weighted average call money rate (WACR).
- Bank Rate: It is the rate at which RBI is ready to buy or rediscount bills of exchange or other commercial papers. This rate has been aligned to the MSF rate and, therefore, it changes automatically as and when the MSF rate changes alongside policy repo rate changes.
- Cash Reserve Ratio (CRR): The average daily balance that a bank is required to maintain with RBI as a share of such per cent of its net demand and time liabilities (NDTL).
- Statutory Liquidity Ratio (SLR): This is the share of NDTL that a bank is required to maintain in safe and liquid assets, such as, unencumbered government securities, cash and gold. Changes in SLR often influence the availability of resources in the banking system for lending to the private sector.
- Open Market Operations (OMOs): These include both, outright purchase and sale of government securities, for injection and absorption of durable liquidity, respectively.

- Market Stabilization Scheme (MSS): This instrument for monetary management was introduced in 2004. Surplus liquidity of a more enduring nature arising from large capital inflows is absorbed through sale of short-dated G-Secs and T-Bills. The cash so mobilized is held in a separate government account with RBI.
- Long Term Repo Operations (LTROs): From the fortnight beginning on February 15, 2020, RBI conducts term repos of one-year and three-year tenors of appropriate sizes with a view to assuring banks about the availability of durable liquidity at reasonable cost relative to prevailing market conditions. LTRO is going to be the guiding principle for near permanent liquidity management.

The objective of the monetary policy is to ensure a stable sovereign bond market that would help in establishing a reliable sovereign yield curve for the market to price risky debt of non-sovereign borrowers and issuers by charging a spread for relative risk involved in the transaction. The liquidity of the sovereign bond market or G-Sec market is extremely important as artificial pricing can jeopardize the bond market development. The monetary policy over the years has helped in establishing a well-functioning G-sec market in India and also helped corporate bond market to grow in terms of issuance.

1.7 Evolution of Debt Markets

India has a large bank-dominated financial system with banking sector providing large credit to corporates. The regulators – both RBI and SEBI – have been putting in place many structural changes to improve the debt market access so that the dependence on banks reduces.

Corporate Bond Market: Global Scenario

At over 322% of GDP, global debt at the end of 2019 was 40 percentage points ($87 trillion) higher than at the onset of the 2008 financial crisis. As at end of 2019, in mature markets total debt topped $180 trillion or 383% of these countries' combined GDP, while in emerging markets, at $72 trillion, it was double the level it was in 2010, driven mainly by a $20 trillion surge in corporate debt. China's debt was nearly 310% of its GDP - one of the highest in emerging markets (2019). Domestic bonds had the highest share in total debt securities with the share of general government debt at nearly 49% of total debt outstanding.

Globally corporate debt markets are Over the Counter (OTC) markets. The transactions are concluded among large institutions or dealers using a telephonic link rather than accessing exchange platforms like equity markets. As these markets are wholesale in nature with very large institution taking part, retail investors are generally absent and they typically invest through collective investment scheme like Mutual funds.

Corporate Bond Market in India

In India, corporate debt transactions are executed bilaterally between the counterparties and reported to the exchanges for settlement purposes. Recent years have seen increased collective investment vehicles such as mutual funds and alternative investment funds (AIFs) taking part in debt market investment. Mutual funds have played a very crucial role in channelizing the savings to the debt oriented schemes.

In order to stimulate flow of foreign investment into debt market, regulators have gradually increased the limits for investment by Foreign Portfolio investors. FPI investment in corporate bonds is also subject to aggregate ceilings, which are nominally lower than the aggregate ceiling on government bonds but represent a higher percentage of outstanding corporate debt securities. The authorities also relaxed the maturity limits on FPI debt holdings, lowering the minimum maturity to one year, from the previous three-year limit. Consistent investment interest by domestic institutions like mutual funds, pension funds and insurance funds as well as foreign portfolio investors (FPIs) has helped in developing the corporate bond market.

1.8 Market Dynamics

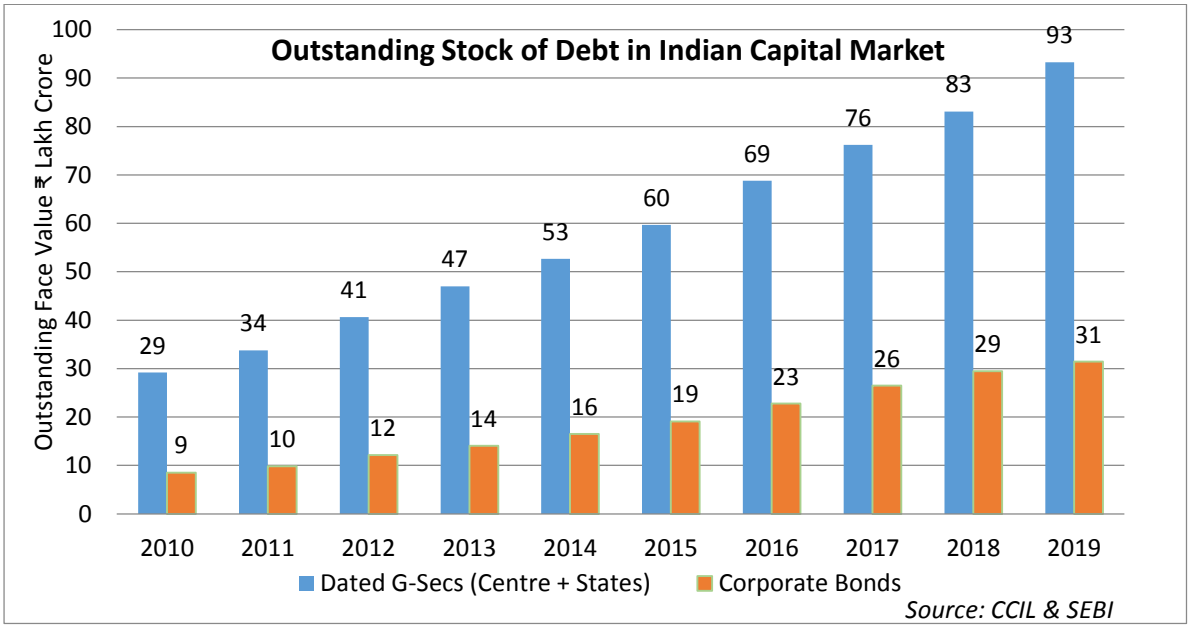
The debt market in India has grown significantly over the past two decades. However, it is still dominated by the government debt segment although the share of the Central Government has been gradually coming down and that of the States rising. The extent of outstanding corporate bonds as a percentage of a country's GDP is often referred to as Penetration. The penetration data is an indicator of the level of development of the bond market in a country. Penetration of bond markets in India, however, remains low in comparison to developed countries.

Table 1.1:

Indian Debt Market Key Ratios (IMF)						
Year	Total private debt, loans and debt securities (percent of GDP)	Household debt, loans and debt securities (percent of GDP)	Non-financial corporations debt, loans and debt securities (percent of GDP)	General government debt (percent of GDP)	Central government debt (percent of GDP)	Nominal gross domestic product (INR billions)
2000	31.19	2.55	28.64	73.65	55.60	21774.13
2001	31.83	3.03	28.80	78.73	57.01	23558.45
2002	35.08	3.50	31.58	82.85	59.82	25363.27
2003	34.83	4.49	30.34	84.24	57.22	28415.03

2004	38.37	6.30	32.07	83.29	55.13	32422.10
2005	42.97	7.90	35.07	80.89	52.18	36933.69
2006	47.52	9.56	37.96	77.11	49.09	42947.06
2007	50.04	10.08	38.37	74.03	47.44	49870.90
2008	54.93	10.10	43.40	72.74	47.50	56300.60
2009	52.54	8.74	43.63	71.09	49.36	64778.30
2010	55.81	8.68	46.58	66.04	44.74	77841.20
2011	58.06	8.68	48.53	68.29	45.77	87363.30
2012	58.94	8.68	50.49	67.66	47.09	99440.10
2013	59.52	8.89	51.53	67.38	46.98	112335.20
2014	58.53	9.19	50.30	66.83	46.03	124679.60
2015	58.55	9.65	49.95	68.78	45.77	137718.70
2016	54.65	9.82	44.82	67.67	45.62	153623.90
2017	53.30	10.50	45.29	67.83	44.26	170950.10
2018	54.81	11.05	45.48	68.05	43.87	190101.60

Chart 1.5:



The Indian corporate bond market has grown over the years. The issuances are predominantly through private placement and dominated by high credit issuers. In 2019-20, 71% of the issuances were by entities rated 'A' or higher, of which 'AAA' had a share of nearly 44% of total primary issuances.

Table 1.2:

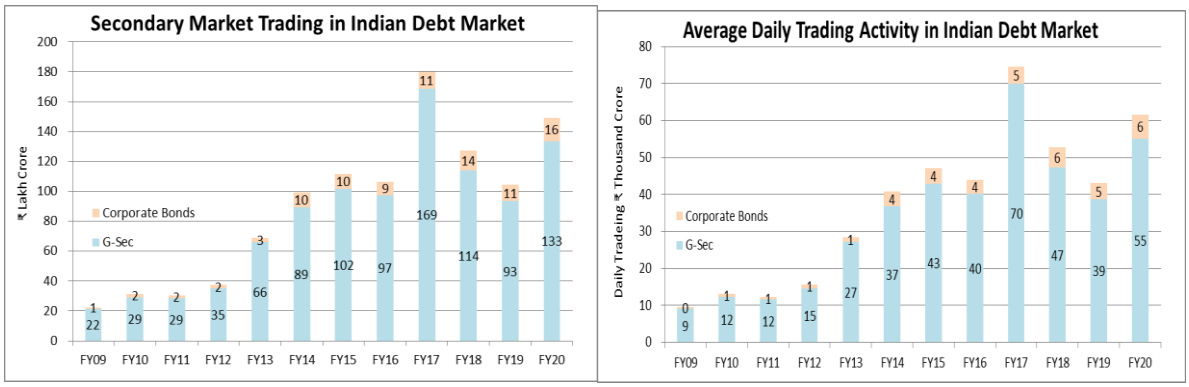
Rating Analysis of Primary Issuances								Amount (₹ Crore)	
Year	Ratings								
	AAA	AA	A	A1	BBB	BB	B	C	NA
FY18	2,57,033	1,05,780	19,643	-	5,527	2,341	773	28	1,41,931
FY19	2,47,660	92,257	10,190	800	6,586	2,049	200	150	82,138
FY20	1,02,100	51,454	12,026	0	4,048	831	477	0	63,657
Source: CCIL									

Table 1.3:

Trading Activity in Indian Debt Market								
	Outright G-Sec Market				Corporate Bond Market			
	Total		Average		Total		Average	
Period	Trades	Value (₹ Crore)	Trades	Value (₹ Crore)	Trades	Value (₹ Crore)	Trades	Value (₹ Crore)
FY09	2,45,873	21,62,135	1,042	9,162	-	86,327	-	367
FY10	3,16,505	29,12,293	1,324	12,185	-	209,163	-	879
FY11	3,32,346	28,64,444	1,340	11,550	12,219	190,001	49	769
FY12	4,12,403	34,92,733	1,726	14,614	18,313	240,106	77	1,009
FY13	6,57,073	65,88,036	2,715	27,223	29,583	292,918	123	1,215
FY14	8,18,509	89,39,292	3,368	36,787	69,518	972,156	287	4,017
FY15	9,78,654	1,01,66,302	4,129	42,896	72,364	10,13,504	305	4,276
FY16	8,83,363	97,38,000	3,650	40,240	63,701	9,05,333	264	3,757
FY17	13,40,376	1,68,55,738	5,562	69,941	72,416	11,24,988	300	4,668
FY18	9,18,130	1,13,85,918	3,810	47,244	50,631	13,50,033	210	5,602
FY19	8,04,146	93,41,044	3,323	38,599	37,813	10,90,407	156	4,506
FY20	9,63,385	1,33,45,845	3,981	55,148	43,619	15,55,518	180	6,401
Source: CCIL								

The private placement of debt as well as transactions in debt securities generally results in fragmentation, low liquidity and inefficient price discovery. For example, 24,010 corporate bonds were outstanding at end-December 2019 with an average outstanding size of only ₹131 crore as compared to only 116 outstanding Central Government dated securities with an average outstanding size of ₹54,138 crore. This has been a major cause of the illiquidity in the secondary market despite regulatory measures to give a boost to the segment. As part of its efforts to boost corporate bond market liquidity, SEBI has facilitated reissuance of corporate bonds to reduce fragmentation.

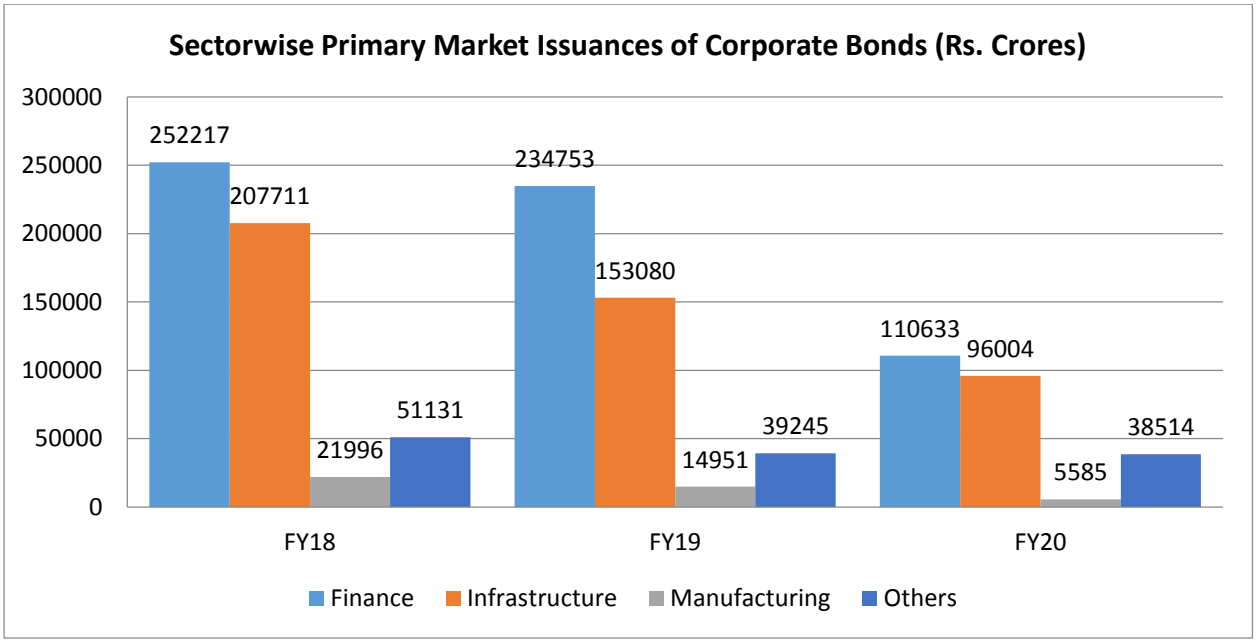
Chart 1.6:



Secondary market trading in corporate bonds has picked up gradually in the recent past, with trading volumes rising nearly 8 times from ₹2 lakh crore in 2009-10 to nearly ₹16 lakh crore in 2019-20. However, this is only 12 per cent in terms of the volumes in the outright G-sec market. Trading is entirely OTC with trades settled bilaterally and reported to stock exchanges. The most significant classes of investors are the insurance companies and mutual funds followed by banks, national pension savings schemes and employee provident funds. FPIs and other categories of investors account for the remaining share.

Sector-wise breakup of issuances in the primary market for corporate debt shows the dominance of finance and infrastructure companies which account for nearly 90 per cent of total issuances.

Chart 1.7:



The primary market witnessed a dip in issuance in recent years after the debacle of ILFS and DFHL where investor lost appetite for corporate papers due to large value defaults.

Sample Questions:

1. Debt securities are often called fixed income securities because _____.
   (a) The government fixes the maximum rate that can be paid on bonds
   (b) They are held predominantly by older people who are living on fixed incomes
   (c) They pay a fixed amount at maturity
   (d) They promise either a fixed stream of income or a stream of income determined by a specific formula

   Ans: (d)

2. A Corporate debt instrument's rating movement from AAA to AA indicates: _____.
   (a) Deterioration in Country's Economic parameters
   (b) Deterioration in issuer's financial capability
   (c) Change in Government regime in domestic market
   (d) Changes in Central bank policies

   Ans: (b)

3. Ratings of a bond determine its spreads over _____.
   (a) Sovereign bonds
   (b) Currencies
   (c) Issuers
   (d) Derivatives

   Ans: (a)

4. Monetary policy at its core is about determining _____.
   (a) Credit flow
   (b) Interest rate
   (c) Inflation
   (d) Growth

   Ans: (b)

5. What is the average daily balance that a bank is required to maintain with RBI as a notified percentage of its NDTL?
   (a) CRR
   (b) SLR
   (c) WACR
   (d) LAF

   Ans: (a)

CHAPTER 2: TYPES OF FIXED INCOME SECURITIES

LEARNING OBJECTIVES:

After studying this chapter, you should know about:

- Classification of Fixed Income Securities based on Type of Issuer
- Classification of Fixed Income Securities based on Maturity
- Classification of Fixed Income Securities based on Coupon
- Classification of Fixed Income Securities based on Currencies
- Classification of Fixed Income Securities based on Embedded Options
- Classification of Fixed Income Securities based on Securities
- Other Fixed Income Securities in India

A bond is a financial security issued by a legal entity to raise funds from the financial market and agrees to refund/return the borrowed amount (principal) at the end of the contract period or at various time intervals as given in the indenture along with the promised interest or coupon. Agreed annual interest promised by the issuer on the bond is generally referred to as Coupon. A bond is akin to a loan with a maturity and coupon rate paid at various intervals viz. quarterly or half-yearly or annually. However, it differs from a loan mainly with respect to its tradability. A bond is usually tradable and can change many hands before it matures; whereas a loan usually is not traded or transferred freely. A loan brings permanent risk to the lender till the loan is repaid but the bond holder can transfer his risk to other risk takers through efficient pricing mechanism. The value of the loan does not change but the value of the bond changes on continuous basis depending on future interest rate regime in the economy as well as the credit worthiness of the borrower. While bonds can be classified in many ways, for ease of understanding, the basic classification of bonds can be considered based on the following criteria:

- Based on issuers;
- Based on maturity;
- Based on coupon;
- Based on currencies;
- Based on embedded options;
- Based on priority of claims;
- Based on purpose of issue;
- Based on underlying;
- Based on taxation.

In this unit we shall discuss the various classifications of bonds based on their inherent features.

2.1 Classification of fixed income securities based on the Type of Issuer

The borrowers of funds who borrowed by the way of issuing of bonds are called Issuers. Bonds are usually gauged for their riskiness based on the issuer's profile. The value of the bond mainly depends on the ability of the borrower to service the debt obligations as per the bond indenture.

2.1.1 Government Bonds / Sovereign Bonds / Gilt edged Bonds

A sovereign bond is issued by the government and is typically denominated in the domestic currency to support planned and unplanned expenditures. Government bonds are also known as "sovereign debt" and are generally issued via auctions and traded in the secondary market. Government bonds issued in local currency are considered risk free as the Government, being a sovereign entity, can print the currency to repay its obligation to bond holders. However, as demonstrated during the European debt crisis (2008-2012), Governments may also default in debt payments in case of an emergency situation. Because of their relative low risk, government bonds typically pay lower interest rates than the bonds issued by other issuers in the country.

In India, government bonds constitute the largest segment of the fixed income market. This also includes the securities issued by the various State Governments and Union Territories, which are known as State Development Loans (SDLs).

Indian Government Securities market (G-sec) also includes the special securities issued by the central and state governments in India. Special securities are issued by the Government for providing various subsidies like oil, fertilizer, bank recapitalization, etc.

2.1.2 Municipal Bonds

Local authorities may also issue bonds to fund projects such as infrastructure, libraries, or parks. These are known as "municipal bonds", and often carry certain tax advantages for investors. Municipal bonds are also known as "muni bonds" or "muni". A municipal bond is categorized based on the source of its interest payments and principal repayments. For example, a general obligation bond (GO) is issued by governmental entities and is not backed by revenue from a specific project but rather by the credit and taxing power of the issuing jurisdiction. GO bonds are primarily used to subsidize the development of public projects. On the other hand, a revenue bond is a category of municipal bonds supported by the revenue from a specific project, such as a toll bridge, a highway or a local stadium. Revenue bonds that finance income-producing projects are thus secured by a specified revenue source. In India, while very few local authorities or municipal authorities have issued such bonds, the market is gradually picking up. The Ahmedabad Municipal Corporation was the first municipal corporation in Southeast Asia to raise money through public issuance, when it had raised ₹100 crore through this route in 1998.

2.1.3 Corporate Bonds

A corporate bond is issued by a corporate to raise capital. The performance of the bond during its life depends on future revenues and profitability of the corporate. Debt is typically cheaper source of financing for corporates and, unlike issuance of more equity, their ownership structure is not diluted. In some cases, the corporate's physical assets may be used as collateral. Corporate bonds carry higher risk vis-a-vis government bonds and hence the bond holders expect higher interest rates to compensate for the additional risk they take while investing in the bond. Corporates issue short term papers like Commercial papers (CPs) to fund their short-term requirement or for their working capital funding.

The corporate papers are issued either through public issuance or private placements. The creditworthiness of the issuer (i.e., issuer's ability to discharge its financial obligations) is to be assessed periodically by one or more of credit rating agencies. The bond's credit rating, and ultimately the company's credit rating, impacts the market price of the bond in both primary and secondary markets. The Credit Rating Agencies (CRAs) assign ratings through letter grades for their common and global understanding. The highest quality (and safest) bonds are given "AAA", while the high risk bonds are known as "junk" or "high-yield bonds". The difference between the yields on corporate bonds and government bonds is called the credit spread.

2.1.4 Securitized Debt

Securitization is the process of monetizing illiquid loan assets of a lender such as a bank, into a liquid pool of tradable assets. Securitization is achieved by creation of a Special Purpose Vehicle (SPV) and structuring the pool of loans into tradable bonds. Securitized (or asset-backed) securities transfer ownership of assets (i.e., loans and receivables) to the SPV.

2.2 Classification of fixed income securities based on Maturity

Bonds are issued for various maturities depending on the requirement of funds as well as the demand from the investors. Long term bonds are generally costlier than short term loans as the funds are locked in for a longer period of time while investors may suffer from illiquidity. Bonds may be classified in terms of maturities like ultra-short term, short term, medium term and long term. Short term borrowings are typically made for working capital requirement where as long term funds are used for project, capital and infrastructure funding. Collective investment schemes also create debt oriented funds using such maturities. The returns on bonds by similar rating class of issuers also vary according to the maturity, which forms the basis of yield curve theories.

2.2.1 Overnight Debt / Borrowings

Typically, banks borrow overnight funds from the money market as well as from the RBI. These borrowings can be collateralized or clean. Collateralized borrowings cost less vis-à-vis

clean borrowings. The RBI plays a very important role in this market through absorption or supplying liquidity through banks and Primary Dealers.

2.2.2 Ultra Short Term Debt (Money Market)

Short term borrowings up to one year are covered under this category. Mostly, money market instruments like Commercial Papers (CP), Certificate of Deposits (CD), Treasury Bills (TB), Cash Management Bills (CMB), etc. belong to this category.

2.2.3 Short Term Debt

Bonds with maturity spanning from 1 to 5 years are referred to short term bonds. Bonds maturing within a year are classified under money market instruments as discussed above.

2.2.4 Medium Term Debt

These are bonds maturing in 5 to 12 years. These are also referred to as intermediate bonds. Generally, the bulk of debt issuances take place in this segment.

2.2.5 Long Term Debt

These are bonds with maturity beyond 12 years. Mostly Government of India bonds are of long term maturity.

2.3 Classification of fixed income securities based on Coupon

The promised interest as per the indenture of the bond is referred to as the coupon. The coupon payments on bonds have a pre-determined payment frequency and may be paid annually, semi-annually, quarterly or monthly. Bonds are classified on basis of coupons as these are returns on the investment made by the holders.

2.3.1 Plain Vanilla Bonds

A plain vanilla bond is the simplest form of a bond with a fixed coupon and defined maturity and is usually issued and redeemed at the face value. It is also known as a straight bond or a bullet bond. These bonds have intermittent cash flows in the form of coupons received as well as the final cash flow of the face value of the bond on maturity.

2.3.2 Zero-Coupon Bonds

A zero coupon bond (ZCB) is a discounted instrument which does not pay any interest and are redeemed at the Face Value of the Bond at the time of maturity. These bonds are issued at a discount and redeemed at the face value with the difference amounting to the return earned by the investor. ZCBs have a single cash flow at maturity which is equal to the face value of the bond. Common examples of ZCBs in India include Treasury Bills and Cash Management Bills and STRIPS created by separating and trading independently (in other words “stripping off”) the coupons from the final principal payment of normal bonds. ZCBs are highly sensitive to changes in the interest rate as they do not have intervening cash

flows and are generally used by long term fixed income investors such as pension funds and insurance companies to gauge and offset the interest rate risk of these firms' long-term liabilities.

2.3.3 Floating Rate Bonds

Floating rate bonds (FRBs) do not pay any pre-fixed coupons but are linked to a benchmark interest rate (generally a short-term rate like the 182-day Treasury bill rate in India). The coupon rate is reset on each coupon payment date. When the general interest rate rises in the market, the benchmark interest rises and hence does the coupon on the FRBs. The same situation reverses when the interest rate falls. FRBs typically trade very close to their face value as interest resets happen at regular intervals. These instruments are generally immune to interest rate risk and are considered conservative investments.

2.3.4 Caps and Floor

Most FRB issuers may issue bonds which will cap their interest payment obligation if the interest rate rises. These instruments may also provide for a floor beyond which the interest rate will not fall in order to protect the interest of the investors. If an FRB has both a cap to protect the issuer and a floor to protect the investor, it is called a "Collar".

2.3.5 Inverse Floater

These types of bonds are similar to FRBs in that the coupon is related to the benchmark linked to the bond (but it is inversely related in case of Inverse Floaters). If the benchmark increases, the Coupon falls and vice versa. For example, in India generally the interest rate on such bonds is linked to a negative spread over the fixed coupon rate. The spread is usually few percentage points over the benchmark MIBOR rate. If the interest rates go up, corporates end up paying less as the coupon will be a few percentage point lower than the original coupon rate. This has mostly been used by NBFCs to raise funds while mutual funds are the primary investors.

2.3.6 Inflation Indexed Bonds

These are a type of FRBs which protect investors from the adverse effects of rising prices by being indexed to an inflation measure like the WPI or CPI in India. Only the face/par value or both par value and coupons may be indexed against the inflation measure.

2.3.7 Step Up/Down Bonds

These bonds are designed to pay lower coupon in the initial years of the bond and higher coupon towards maturity. These bonds are preferred by issuers like start-ups who expect their cash flows to balloon after some time and hence would like to service the bonds with lower cash flows at the beginning. The investors of these bonds also take higher risk as higher cash flows are expected after some time and hence expect higher interest rate to make the investment attractive. These bonds are generally risky.

Step down bonds are the exact opposite of step up bonds. These bonds pay high interest at the beginning of the bond and as the time moves towards maturity, the coupon drops. Such bonds are usually issued by companies where revenues/profits are expected to decline in a phased manner; this may be due to wear and tear of the assets or machinery as in the case of leasing.

The step up and step down bonds are used for better cash flow planning of both issuers and investors.

2.3.8 Deferred Coupon Bonds

This is a mixture of coupon paying bond and a ZCB. In the initial years, these bonds do not pay any interest but these bonds pay very high interest after a few years and typically few years before the maturity. The corporates having high gestation period typically prefer this kind of arrangement.

2.3.9 Deep Discount Bonds

When a zero coupon bond is issued at a high discount to the Face Value, it is generally referred to as a Deep Discount bond. Normally, a discount of 20% or more with relatively longer maturity is the main characteristics of the Deep Discount Bond. Typically, infrastructure companies issue such kind of bonds as their gestation period is very long. These bonds carry high risk. Junk bonds are examples of deep-discount bonds.

2.4 Classification of fixed income securities based on Currencies

With increased globalization of financial markets, often investments are spread across continents yielding cash flows in different currencies. Hence, bonds can also be classified on the basis of currencies.

2.4.1 Foreign currency Denominated Bonds

Many Governments as well as corporates issue bonds in overseas market in foreign currency denominations. For example, Indian companies typically issue US Dollar denominated bonds to raise cheaper funds from international markets. However, these bonds carry foreign currency risk as any devaluation of the domestic currency would increase the cost for the issuers as its repayment would be done by acquiring foreign currency from the market at higher exchange rate. Generally, bonds are named after the country of the currency in which the bond is issued, e.g. Yankee bonds, Samurai bonds, etc. A Yankee bond is a U.S. dollar denominated bond that is issued in the USA by a non-US issuer. A Samurai bond is a yen denominated bond that is issued in Japan by a non-Japanese issuer.

A dual currency bond is issued with coupon being payable in one currency while principal would be paid in another currency.

2.4.2 Masala Bonds

Masala bonds are the debt securities issued by Indian corporates to raise money outside India but the debt is denominated in Indian Rupees. Masala as a word is recognized the world-over for Indian spices and was thus used by the World Bank- backed International Finance Corporation (IFC) for global bonds of Indian corporates. Unlike dollar bonds, where the borrower takes the currency risk, in case of the masala bonds, the investors bear the currency risk. The first masala bond was issued by the IFC in November 2014 when it raised a ₹1,000 crore to fund infrastructure projects in India. Later in August 2015, IFC for the first time issued green masala bonds and raised ₹3,150 crore to be used for private sector investments that address climate change in India. In July 2016, HDFC became the first Indian company to issue Masala bonds to raise funds.

2.5 Classification of fixed income securities based on Embedded Options

An embedded option bond is an instrument with a provision of callability by the issuer and puttability by the investor. The optionality influences the price of the bond as the risk is higher for these bonds. The “Call” feature incorporates the right of the issuer to call back / repay the bond on a specific date. The same way, the “Put” provision of the bond gives the right to seek redemption of the bond by the investor on a particular date. A bond having call provision is likely to be called when the cost of refinancing the bond is low due to fall in interest rates. A bond having “Put” option may encourage the investors to submit the bond for redemption when interest rate rises. The bonds with embedded options are valued using option premia.

2.5.1 Straight Bonds

A straight bond is a bond that pays interest at regular pre-determined intervals and at maturity pays back the principal that was originally invested. A straight bond is also called a plain vanilla bond or a bullet bond. These bonds pay regular coupon which is typically fixed at the beginning or at the issuance time. It is the most basic form of debt investments.

2.5.2 Bond with a Call Option

A bond with a Call provision gives the right to the bond issuer to call back the bond and pay the borrowed funds to investors before the original maturity date but at the pre-fixed call date. The issuer invokes this right only when the market interest rate is lower than the interest in the callable bond. However, the callable bonds generally require premium to be paid at the time of redemption when called.

2.5.3 Bond with a Put Option

A bond with a Put provision gives the right to the bond investor to seek redemption of the bond from the issuer before maturity date but at the pre-fixed Put date. The investor invokes this right only when the market interest rate is higher than the interest in the

puttable bond. However, these bonds generally require discount at the time of redemption when the investor chooses to redeem the same before maturity.

2.5.4 Convertible Bonds (including FCCB)

Convertible bonds are the bonds issued by corporates and such bonds get converted to equity shares at a specified time at a pre-fixed conversion price. The bondholder has the right to convert the said bonds to equity shares and issuing company cannot refuse the conversion as it is agreed at the time of the issuance. These bonds are preferred by foreign investors who would like to test the company for some time before talking an exposure to the equity shares of that company. This is a hybrid security as the price of the bond depends on market interest rate, equity share prices and the rating of the issue. The agreed conversion ratio determines the number of shares the bond holder would get if he/she exercises the option of conversion on the agreed date. The conversion price is set at the time of issuance of the security. The conversion price and ratio can be found in the bond indenture or in the security prospectus.

The convertible bond is ideal for investors seeking gain from rising equity prices as the conversion price is decided at the time of issuance. An investor has to always calculate the value of the bond on conversion date taking the face value and the future promised interest. If the stock acquired through conversion is priced higher than the value of the bond, then the investor would convert the said bond. There are mandatory convertible bonds that are required to be converted by the investor at a particular conversion ratio and price. Exchangeable bonds are like the convertible bonds but these bonds can be exchanged for equity shares of some other issuer and then issuer would take the risk of buying the equity stock from the market to exchange against the bonds. Typically, these bonds are exchanged for equity stocks of some group companies of the issuer. A foreign currency convertible bond (FCCB) is a special type of bond issued in the currency other than the domestic currency. In other words, companies issue foreign currency convertible bonds to raise money in foreign currency. These bonds are preferred by foreign investors as these are bonds but can be exchanged for equity shares if the same is beneficial to the investor.

2.5.5 Warrants

A warrant is a bond with option rights. For a limited time, it confers the right to buy equity securities, such as shares, of the bond issuer at a predetermined price (exercise price). Warrants are derivative instruments like options that give the right but not the obligation to the investor to buy an equity stock at a certain price before expiration. As these are option contracts, it will have strike or exercise price. Warrants can be American or European - an American warrant can be exercised at any time before or on the expiration date but a European warrant can be exercised on the expiration date only. Warrants have Call and Put types and these are traded in the Over the Counter (OTC) market.

Warrants are issued as a sweetener to bond holders that allow the issuer to offer a lower coupon rate. Warrants can be separated from the bonds and can be traded in the secondary market. Covered warrants are issued by financial institutions who might have acquired these stocks and holding them in their portfolio.

2.6 Classification of fixed income securities based on Security

All bonds are in essence fungible loans for which returns ultimately depend on the servicing ability of the issuer. Bonds can be secured or unsecured. These can be senior or junior types depending on their claim in the company's asset at the time of liquidation. Bonds lower in priority of claims offer higher yields to compensate for the risk inherent in them. Bonds may also be secured against specific assets of the user. Hence, it is critical for investors to be aware of the priority in claims of the security they intend to invest in depending on their risk appetite.

2.6.1 Secured debt

The debt payout at the time of liquidation is made according to the seniority of bonds. Junior bonds are typically subordinate to senior bonds. The senior bonds are put at the top of the hierarchy in the structure as the "secured" debt. Otherwise, the age of the debt determines which has seniority if bonds are not secured. Secured bonds have collateral ranking and they would be paid first out of the assigned assets which have been collateralized against such debt. This makes it more secure with higher recovery rate vis-à-vis lower level unsecured junior bonds in the event the company defaults. Secured debt holders are paid out first in case of liquidation.

2.6.2 Unsecured debt

Unsecured debt instruments are issued by companies without any specific collaterals allocated against these issuances. Companies issue such unsecured debt using their name and reputation in the market. These bonds are paid out last, if any bankruptcy happens. But senior unsecured debt is paid out first and then the junior unsecured debt is paid out.

2.6.3 Subordinated debt

Subordinated bonds are issued by companies that pay higher coupon but are more risky as these bonds are paid out just before the equity holders at the time of liquidation. In India, banks issue subordinate bonds to shore up their Tier II capital as per the capital adequacy requirement.

2.6.4 Credit enhanced bonds

Credit enhancement is a strategy to show the investors that the company would be able to pay back the borrowings as there is some kind of guarantee system in place to support the borrowings. It is a method whereby a borrower or a bond issuer attempts to improve the credit worthiness of its debt offering. Through credit enhancement, the lender or bond

holder is provided with reassurance that the borrower will meet its repayment through an additional collateral, insurance, or a third party guarantee. A company lowers its cost of borrowing using credit enhancement. The credit enhancement also leads to better rating grade for the bond and reduces the risk for investors.

2.7 Other fixed income securities in India

Apart from the basic categories of bonds described above, there are several other types of fixed income securities which attract investors with specific investment requirements. Some of these instruments are discussed below.

2.7.1 Sovereign Gold Bonds

Sovereign Gold Bonds (SGB) are government securities denominated in grams of gold. These are considered as substitute for physical gold. SGBs are issued by RBI on behalf of Government of India in order to reduce the import of gold into the country. These are paid out in domestic currency but the value is determined using the price of gold at the time of issue and redemption. These are held in demat form and remove the risk of physical gold holding and are free from issues like making charges and purity in the case of gold held in jewelry form. Minimum investment is one gram with a maximum limit of subscription of 4 kg for individuals, 4 kg for Hindu Undivided Family (HUF) and 20 kg for trusts and similar entities notified by the government from time to time per fiscal year (April-March). SGBs bear interest at the rate of 2.50 per cent (fixed rate) per annum on the amount of initial investment.

2.7.2 Perpetual Bonds

Perpetual bonds do not have specified maturity but the bond issuer pays interest on the bond to the investor till the issuing entity exists. The yield offered by these bonds is significantly higher due to the associated high risks such as:

a. Perpetual bonds are lower in order of liquidation and they are considered as subordinate to senior level bonds.
b. The perpetual bonds are non-cumulative in nature and the interest is not guaranteed in case of loss made in a year.
c. Perpetual bonds have “Call” provision which can be used by the issuer to call back the bond.
d. Perpetual bonds have very low liquidity and it is extremely difficult to sell such bonds in the market.

In India, banks and non-banking finance companies (NBFCs) have been major issuers of perpetual bonds to meet the Basel III norms (also known as AT-1 instruments).

2.7.3 AT1 Bonds

As per Basel III norms, Indian banks have to maintain capital at a minimum ratio of 11.50 per cent of their risk-weighted assets. Out of these, 9.50 per cent needs to be in Tier-1 capital

and only 2 per cent in Tier-2 capital. Tier-1 capital can include perpetual bonds without any expiry date. These instruments are often treated as quasi-equity. RBI is the regulator for these bonds in India.

AT1 bonds carry a face value of ₹10 lakh per bond and are complex hybrid products. These bonds pay higher rate of interest compared to similar, non-perpetual bonds. However, the issuing bank has no obligation to pay back the principal to the investors. Banks issuing AT1 bonds can skip interest payouts for a particular year or even reduce the bonds' face value without consulting their investors. These thresholds are specified in their offer terms. Moreover, for a bank on the brink of collapse, RBI can direct the bank to cancel its outstanding AT1 bonds without consulting its investors.

2.7.4 Tier-2 Bonds

Tier-2 bonds are components of Tier-2 capital and these are subordinate to Tier-1 capital and further divided into upper and lower Tier-2 capital.

Features of Tier-2 bonds issued by banks in India are:

- It is issued for raising capital only.
- It can be 50% of the total capital of the Bank.
- Original maturity is 15 years for upper tier and 5 years for lower tier.
- Upper Tier-2 instrument can be issued in foreign currency upto 25% of unimpaired Tier-1 capital. Lower Tier-2 instrument can be issued in foreign currency after taking approval of RBI on case-by-case basis.
- Call option is allowed subject to certain conditions.
- These are subordinated bonds.

2.7.5 Savings Bonds

Also known as RBI savings bonds, these bonds (with tenure of seven years with half-yearly compounding and cumulative and non-cumulative options) provide retail investors a safe fixed income investment option with reasonable returns. These bonds are issued with a lock-in period of seven years. These bonds are generally illiquid and cannot be used as collateral for loans.

2.7.6 High-Yield Bonds

High-yield bonds are bonds that pay very high interest rates because they have lower credit ratings than investment-grade bonds. These bonds are more likely to default and hence they must pay a higher coupon or yield than investment-grade bonds to compensate investors.

2.7.7 Green Bonds

Green bonds are a type of bond designed to raise funds to invest in environmental or climate change mitigation projects. Green bonds are issued by financial, non-financial or

public entities where the proceeds are used to finance 100 per cent green projects and assets. Green bonds are also a barometer for the impacts of climate change on the financial system. The development of vibrant green bond markets allow countries and organizations to mobilize traditional debt investments into projects that can have positive environmental impacts for society. Green bonds also give investors an opportunity to meet their environmental, social and governance (ESG) objectives by creating low-carbon investments.

In November 2008, the World Bank issued its first green bond in response to a request from a group of Swedish pension funds seeking to invest in projects that address climate change. Labeled the world's first green bond, it became a blueprint for the green bond market, providing options for investors to support climate solutions with their investments without sacrificing financial returns. As per the Economic Survey 2019-20, India with $10.30 billion worth of transactions in the first half of 2019, now has the second-largest emerging green bond market after China. Green bonds are designed to raise funds which are then exclusively used for legally documented green projects and environmental or climate change mitigation projects. Issuers should clearly communicate to investors the environmental objectives and follow mandatory reporting on the use of the proceeds to ensure integrity of the market. Climate bonds are focused green bonds, which are specifically linked to climate-change mitigation, adaptation and resilience.

2.7.8 REITs and InvITs

Real estate investment trusts (REITs) and infrastructure investment trusts (InvITs) are innovative vehicles that allow developers to monetize revenue-generating real estate and infrastructure assets, while enabling investors or unit holders to invest in these assets without actually owning them.

2.7.9 Tax-Free Bonds

Tax-free bonds are issued by approved government enterprises to raise funds for a particular purpose with no tax liability on the coupon income and/or on the capital gains. One example of these bonds is the municipal bonds. Many public sector undertakings in India have issued tax-free bonds. Default possibility for these bonds is low. However, these bonds typically tend to have very low liquidity in the market.

2.7.10 Asset-Linked Bonds

An asset-backed security (ABS) is an investment security which is collateralized by a pool of assets, such as loans, leases, credit card debt, royalties, or receivables. Asset-backed securities allow issuers to monetize the receivables. ABS allow issuers to generate cash, which can be used for more lending, while giving investors in the ABS the opportunity to participate in a wide variety of income-generating assets.

2.7.11 Equity-Linked Note

An equity-linked note (ELN) is an instrument that combines a debt with additional potential returns that are linked to the performance of certain equities while protecting their capital. This is a type of structured product appealing to risk-averse investors who nevertheless have a bullish outlook on the market.

2.7.12 Participatory Bonds

A participatory bond is a bond whereby the issuer promises a fixed rate of interest but the coupon may increase or decrease depending on the performance of the company in terms of profit generation. It helps the investor to participate in the revenues/income.

2.7.13 Income Bonds

Income bonds are similar to participatory bonds. However, these bonds do not have a reduction in interest payments when the revenues/income reduces.

2.7.14 Payment in Kind Bonds

These types of bonds pay interest/coupon, not in terms of cash payouts but in the form of additional bonds.

2.7.15 Extendable Bonds

Extendable bonds are bonds that allow the holder to enjoy the right to extend the maturity of the bond.

2.7.16 Extendable Reset Bonds

These are types of bonds which allow the issuer and the bondholders to extend the maturity with a reset in the coupon rate based on the then prevailing market scenario. These bonds have very long maturity periods.

Sample Questions:

1. Which bonds refer to the debt securities issued by a state to finance its capital expenditure?
   (a) GOI securities
   (b) Gilt edged securities
   (c) SDLs
   (d) Municipal bonds

   Ans: (c)

2. The rate of interest paid on the bond is referred to as _____ payment.
   (a) Capital appreciation
   (b) Capital depreciation
   (c) Principal
   (d) Coupon

   Ans: (d)

3. A contract gives the bond holder the right to redeem the bond at a pre-fixed date before maturity. The option embedded in this contract is known as _____.
   (a) Convertible option
   (b) Swaption
   (c) Put option
   (d) Call option

   Ans: (c)

4. The holders of which of these will be paid last in case of a company's default?
   (a) Senior debt
   (b) Senior unsecured bonds
   (c) Junior debt
   (d) Equity

   Ans: (d)

5. Interest on Sovereign Gold Bonds (SGB) is credited _____.
   (a) Annually
   (b) Semi-annually
   (c) Quarterly
   (d) Monthly

   Ans: (b)

CHAPTER 3: RISKS ASSOCIATED WITH INVESTING IN FIXED INCOME SECURITIES

LEARNING OBJECTIVES:

After studying this chapter, you should know about:

- Risk associated with Fixed Income Securities
- Risk Mitigation Tools

Risk is inherent in any financial investment (or financial instrument) and bonds are no different. While fixed income instruments provide regular income to investors, the investors can lose both the principal investment and the promised income, if the borrower moves towards bankruptcy. However, such cases are extreme conditions and the investors can gauge the risk level in a bond investment by looking at its Credit Rating. Investments in government bonds are considered as risk-free investments.

There are certain inherent risks in fixed income products that can impact the net returns earned by the bond holder or investor. Interest rate risk is the single most critical risk for a fixed income security. Factors like inflation, liquidity, market intervention by the central bank, foreign exchange flows, price of competing assets, etc., influence the movement and level of general interest rates in the market. This in turn affects the market price of bonds leading to the investment risk of these instruments.

3.1 Risks associated with fixed income securities

Investors need to understand the risks involved in a fixed income asset before investing in it. Government bonds are considered as risk free and hence provide low return on investment, while corporate bonds in general being riskier provide higher returns to the investor (assuming both were held from issue date till the maturity date). Entities like public sector undertakings or banks are relatively less risky vis-à-vis the pure corporate firms and thus provide returns higher than the government bonds but lower than the corporate papers. Understanding the relative risk involved in fixed income assets helps investors to decide the type of risk they are willing to take while investing. Major risks come from changes in interest rate levels in the economy and changes in the creditworthiness of the borrower. The first group of risk is known as Market Risk while the second group of risk is known as Credit Risk or Default Risk. However, investors can hedge various risks in the fixed income assets by entering into various derivative contracts.

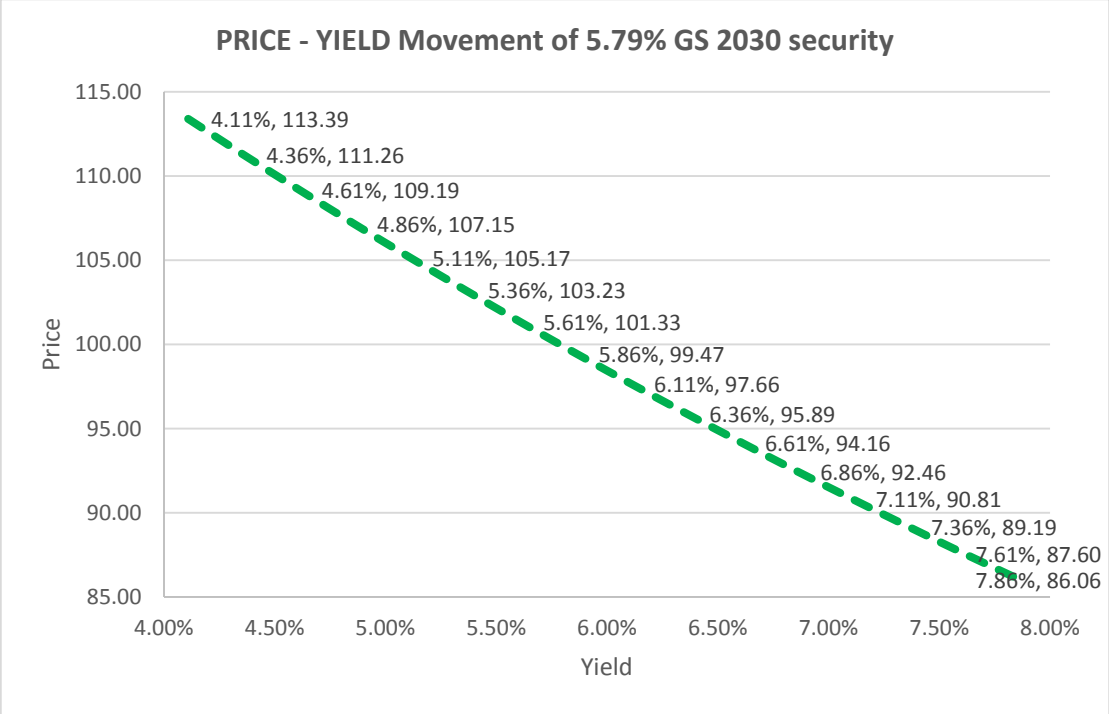
3.1.1 Interest Rate Risk

Bonds are subjected to risk emanating from interest rate movements. The price of the bond is inversely related to the interest rate movement. If interest rate rises, the price of the bond will fall. The same comes from the basic Bond Price equation:

$$PV = \frac{C}{(1+R\%)^1} + \frac{C}{(1+R\%)^2} + \cdots .. + \frac{(C+FV)}{(1+R\%)^n}$$

Here, C is the annual coupon promised on the Bond, R is the present interest rate for similar rated and similar maturity securities, FV is the Face Value of the Bond that would be received by the investor at the time of redemption and PV is the Present Value of the Bond. The basic interest rate risk could be explained by the following figure:

Chart 3.1:



As and when yield of the bond increases, the price of the bond would fall. In the above example, at 4.11% yield, our 5.79% coupon GS 2030 (semi-annual) bond with Face Value of ₹100, maturing on 11-May-2030 would fetch an ex-interest price of ₹113.39[1] on 06-Aug-2020 in the market. If this yield goes up to 7.86% with all other parameters remaining the same, the bond would be valued at ₹86.06 only. This inverse relationship is the outcome of the change in the present interest rate. Coupon on a fixed income security would have been decided based on the interest rate prevailing at the time of its issuance, given the maturity and rating. If currently, the interest rate has moved upward from 5.79% (as in the present case of the bond in example) for the similar kind of securities in the market, investors would not like to buy the old 5.79% security as it provides a lower coupon vis-à-vis new ones providing higher coupons. To enthuse the investor to buy the 5.79% security, the seller has

[1] The price has been arrived using PRICE function in Excel => PRICE=("06-Aug-2020","11-May-2030",5.79%,4.11%,100,2,4) =113.3926

to adjust the price downward to make it comparable with new security that pays higher coupon. Hence, the price to be quoted by the seller would be lower than ₹100 Face Value. This situation would reverse if the interest rate moves below 5.79% and the buyers would have to pay higher price for buying the bond as the market would give them a lower interest rate for their alternative investment. This inverse relationship exists because the fixed Face Value of ₹100 is going to be received at the end of the maturity. The concept of "pulled to par" explains the inverse relationship between the bond price and the yield.

Any investment in bonds has two risks – market risk and credit risk. Market risk can be explained by the change in the price of the bond resulting from change in market interest rates. Further, the coupons that would be received at different points in time in future need to be re-invested at the rate prevailing at the time of receipt of such coupons. If the interest rate falls below the present coupon at the time of reinvestment, the investor would get a lesser cash flow from such re-investment. This is commonly known as re-investment risk arising out of market factors affecting the interest rates.

3.1.2 Call risk

Call risk is the risk of a bond being prematurely called or repaid by the issuer exercising the call option provided in the indenture of the issuance. This typically happens when a corporate decides to refinance its liabilities with a lower cost of borrowing. The call risk makes the bond unattractive to the investor vis-à-vis a non-embedded option bond as it increases uncertainties for the investor. The issuer has to pay a risk premia known as the "Call Premia" for the comfort or right of repaying the debt when the market replacement cost falls. In order to compensate for the call risk, the investor would receive a higher return on the callable bond vis-à-vis a non-callable one.

Estimation of Call Premia can be explained with the simple example of a bond with 10 years of maturity that has a call option at 5 years with 8% coupon with present interest rate (yield) at 8% and the bond without any option is trading at Par. The chance of this interest rate moving upward and downward may have different probabilities as given in Table below.

Table 3.1:

Coupon	Yield	Probability of Call	1-Probability
8%	4%	90%	10%
8%	5%	80%	20%
8%	6%	70%	30%
8%	7%	60%	40%
8%	8%	50%	50%
8%	9%	40%	60%
8%	11%	30%	70%

Since there are various scenarios, we have to calculate the average price of the bond taking all possible scenarios and compare it with the average price of a call free bond with similar maturity and ratings. The difference is the expected call premia the issuer has to pay if it wants a right to call the bond during the life of this bond before the call date subject to our assumption of interest rate scenarios (probabilities). When the probabilities of interest movement change, the premia will also change.

3.1.3 Reinvestment Risk

Reinvestment risk arises when the periodic income received from bonds or other fixed income securities are reinvested after their receipt at the rates prevailing in the market at the time of such receipts. If interest rate is higher at the time of receipt of periodic coupon, the reinvestment would happen at higher rate (beneficial to the investor) but if the market interest rate is low at the time of receipt of the coupons, the investor would be reinvesting the coupons at lower rates. However, it may be remembered that higher interest rate vis-à-vis the coupon would mean capital loss in the market value of the bond if the investor wants to sell it in the market. Therefore, reinvestment risk is the risk that interest rates may decrease during the life of the bond. If an investor wants to hold the security till maturity, then reinvestment risk may become high. Reinvestment risk is an important part of bond investments.

3.1.4 Credit Risk

Bonds are essentially certificates of debt or in other words, loans from the investors to the issuers who promise to repay the principal amount with periodic interest/coupon payments. Particularly for bonds issued by non-government corporates, the price of the bonds depends on the credibility of the corporate issuing it and often offer a yield higher than the risk-free government bonds as the investors are at a risk of losing their capital if the financials of the issuer deteriorate. The spread between Government Bonds and Corporate Bonds of various classes indicates the level of default risk in corporate bonds. Types of credit risk include: Downgrade Risk, Spread Risk and Default Risk.

3.1.4.1 Downgrade Risk

A company's ability to operate and repay its debt issues is frequently evaluated by the credit ratings agencies. Downgrade risk arises for investors when the rating of an issuer is lowered after they have purchased its bonds. If a company's credit rating is downgraded by a rating agency on account of deterioration in its financials, the issuing company faces higher cost for raising new resources. The company’s existing bond holders face a drop in price of their bonds as the cost of funds for the company increases in the market.

The cost of borrowing for the Non-Banking Finance Companies increased drastically after the ILFS crisis as these entities were finding difficulty in getting the funds from the market. The rating companies downgraded the rating of the securities issued by ILFS to “Junk”

category. As the risk perception increased and uncertainty of NBFCs fulfilling their promise of repayment increased, the cost of funding increased dramatically. Hence, increased default risk increases demand for risk premium in the market for corporate sector.

As discussed earlier, each credit rating (such as AAA, AA, A, etc.) represents a level of credit quality and ratings are changed periodically as a company's situation improves or deteriorates. Given enough historical data, the likelihood is calculated that a company at a particular rating will migrate to a different rating over some time period. A "Rating Migration Matrix" gives some idea about possible default due to downgrades. It also gives the possibility of rating migrations in various classes of bonds in a country. For example, the table below shows the average transitions in corporate ratings over a 40-year period. The diagonals are very important to investors as it indicates the percentage of companies retaining their ratings.

Chart 3.2:

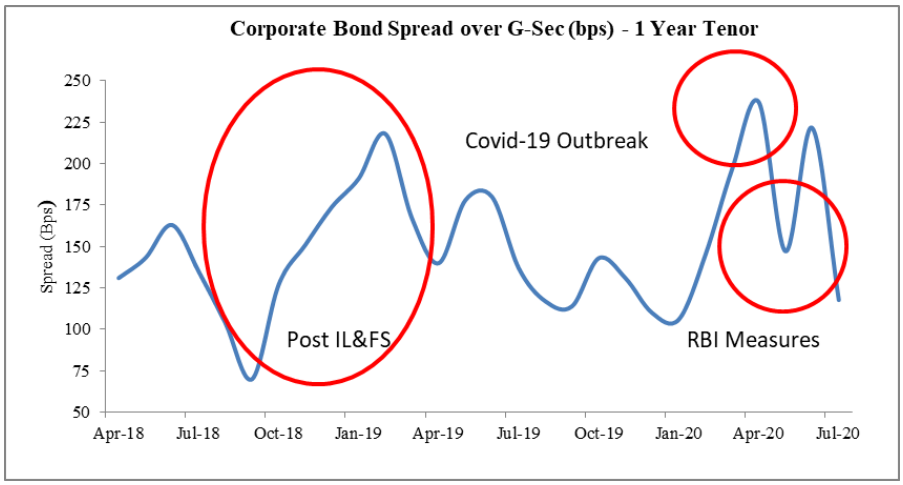
Average One-Year Transition Rates, 1970-2010

From/To:	Aaa	Aa	A	Baa	Ba	B	Caa	Ca_C	WR	Default
Aaa	87.395%	8.626%	0.602%	0.010%	0.027%	0.002%	0.002%	0.000%	3.336%	0.000%
Aa	0.971%	85.616%	7.966%	0.359%	0.045%	0.018%	0.008%	0.001%	4.996%	0.020%
A	0.062%	2.689%	86.763%	5.271%	0.488%	0.109%	0.032%	0.004%	4.528%	0.054%
Baa	0.043%	0.184%	4.525%	84.517%	4.112%	0.775%	0.173%	0.019%	5.475%	0.176%
Ba	0.008%	0.056%	0.370%	5.644%	75.759%	7.239%	0.533%	0.080%	9.208%	1.104%
B	0.010%	0.034%	0.126%	0.338%	4.762%	73.524%	5.767%	0.665%	10.544%	4.230%
Caa	0.000%	0.021%	0.021%	0.142%	0.463%	8.263%	60.088%	4.104%	12.176%	14.721%
Ca-C	0.000%	0.000%	0.000%	0.000%	0.324%	2.374%	8.880%	36.270%	16.701%	35.451%

3.1.4.2 Spread Risk or Basis Risk

Corporate bonds or non-Government bonds pay a spread (depending on their Credit Ratings) over comparable Government securities to compensate investors for the higher risk. The spread keeps on changing dynamically as per the market conditions and the performance of the company. Poor performance means the company would face cash flow problems and may not be able to meet its obligations of interest payment and redemption payments. This would make the company's debt very costly. The spread over comparable Government securities would change keeping in mind the possible default of the company. In tight liquidity situations or when the general market condition is bad, the risk appetite drops in the market and the spread increases. The spread charged for higher rated papers would be far lower compared to the lower rated papers in the market. The Chart below depicts the behaviour of spreads in the Indian markets in response to various stress conditions.

Chart 3.3:



3.1.4.3 Default Risk

Default risk is the possibility of non-payment of coupon or principal when due. Default arises when the company fails to meet its financial obligations towards interest and principal repayments. While credit ratings help to measure an issuer's risk of default, there is still always a risk that some unforeseen event can force the issuer to default. The spread measures the default risk of a bond. If the market perceives an increased possibility of default for a bond, the interest rate for the bond would increase in the market. Junk bonds with very high credit risk or default risk generally pay high interest rates to investors.

3.1.5 Liquidity Risk

Liquidity risk is the risk that the investor would not be able to sell the investment at the time of need. Every investment is an action to defer the present consumption by an investor for a future date. Hence, when such planned consumption time comes, the investor must be able to monetize the investment and convert the same to cash without losing much of its intrinsic value. If the market is liquid to absorb the sale, then the investor would not lose substantially as there would be other investors willing to take the risk on the asset by buying the same from the investor selling it. When the liquidity is tight in the market, investors may find it difficult to sell the asset. Typically, short-term instruments are more liquid as they are like cash instruments whose cash flows would come to the investors shortly (because of nearer maturity) but long-term instruments tend to have a higher liquidity risk.

3.1.6 Exchange Rate Risk

Bonds issued in foreign currency are exposed to exchange rate risk. When the issuer of a foreign currency bond has to pay back the bond principal or the promised periodic coupon, the company has to acquire foreign currency from the market to fulfil its obligations. The cost of acquiring such foreign exchange may increase, if the domestic currency has depreciated against the currency in which bonds have been issued. Currency risk is an

inherent risk for bonds issued in non-domestic currency (i.e., issued by domestic borrowers in international markets).

Masala Bonds issued by Indian entities expose the investors to the exchange rate risk as the Rupee amount is fixed and the investors who are foreign entities would receive Indian Rupees (INR) and have to convert that into their own currency for repatriation. Exchange rate risk is a very important risk consideration for foreign currency denominated bonds.

3.1.7 Inflation Risk

Inflation risk is the risk faced by an investor of inadequacy of funds received from the bond investment to fulfil the deferred needs. While investing in the bond, the investor expected a return level keeping in mind the stable interest rate, as the assumption of stable inflation would have helped him in such assumptions. However, if inflation rate increases suddenly, the cost of goods would increase and the real return would come down. The nominal return may remain the same but the real income after adjustment of inflation would be far lower. A fixed rate bond does not take into account such changing future scenarios while a floating rate bond can take care of such changes as the new interest rate would be keeping in sync with the market rate. When expected inflation levels are higher, investors prefer floating rate bonds or inflation-indexed bonds to save themselves from the risk of higher inflation.

3.1.8 Volatility Risk

Volatility risk affects the bonds with embedded options. The pricing of an embedded option bond takes into account the volatility level to price the same.

3.1.9 Political or Legal Risk

Bonds with tax benefits are exposed to such risks. Tax free bonds may become taxable because of change in Government rules which would impact their pricing. Further, if a Government decides not to pay coupons due to its tight cash position or plans to roll over its debt or pay coupon in the form of new bonds, this can lead to substantial value change for the bonds as investors face higher risk of non-receipt of required cash on planned dates. Government changing repatriation rules may affect the foreign bond investors in a domestic economy.

3.1.10 Event Risk

An event risk refers to an unexpected or unplanned event that forces the value of an investment to drop substantially. Certain events may force companies to seek moratorium on repayment as their business gets affected by such unplanned for events. For example, during the recent Covid-19 pandemic, the travel industry has been severely impacted and many companies in this sector could not service their debt. The impact of this kind of risk is different for each sector and the amount of exposure depends on the sector and the nature of its business.

3.2 Risk Mitigation Tools

An investor needs to buy protection against unexpected losses from the investment in the bond market. There are many hedging tools available in the market to protect the investor from the risk. There are risk cover selling entities who can take over the risk of an investment in exchange of a risk premium. Derivatives are the best ways to buy such protections for investors.

3.2.1 Use of Credit Derivatives

A credit derivative is a protection contract available to investors to protect against the default of a bond issuer in terms of failure. The writer of the credit derivative receives a premium for covering the risk of the investment during the life of the contract. As per the normal contract under a credit default swap, the investor can get the protection of the future coupons and principal of a bond in case the issuer defaults. There are many variations of credit default swaps and these are also traded in global exchanges.

3.2.2 Use of Interest Rate Derivatives

Interest rate derivatives are used to hedge the interest risk of a bond investment. There are many types of interest rate risk hedging contracts and some of them are discussed below:

- Forward Rate Agreements (FRAs): An FRA is a forward contract, where the buyer pays a fixed rate against receipt of a variable rate for a single cash flow. The floating rate is linked to a benchmark interest rate like MIBOR. The principal is notional as it is done in a single currency. The actual payments are calculated based on the agreed notional principal and are paid at mutually agreed time intervals. If the interest rate rises, the floating rate rises, and the receiver of the fixed rate loses value.
- Swaps: A swap is a multi-period FRA but the rule is that the rate is set in advance and payment is made in arrears. It is just like a Bond but only cashless. Like a bond, it has maturity, it has coupon (floating or fixed), frequency of payment, Principal (Notional as it is on the same currency). Swap is commonly referred as Cashless Bond position. Buyer pays fixed and seller pays floating leg which is linked to a benchmark rate or index.
- Futures: A futures contract is similar to a forward contract, but is traded through an Exchange. Interest rate futures are available for investors to hedge their risks. Each Futures contract has a standard expiry and delivery date. These contracts are marked to market on daily basis.
- Options: Option contracts have an underlying security which is a debt obligation. These instruments are used for hedging the risk for the parties involved in a floating-rate loan. The contracts can have both caps and floors as per the choice of the traders.
- Swaptions: A swaption, or swap option, is simply an option to enter into a swap.

- Caps: A cap is a ceiling and is a call option on an interest rate. A caplet (series of caps) is designed to provide the hedge against a rise in the benchmark interest rate for the borrower.
- Floors: The floor is the exact opposite of the cap. A floorlet (series of floors) is used by the lender to protect against falling rates on an outstanding floating-rate loan.
- Collars: The existence of a cap and a floor is normally known as the collar. It is used to manage the interest rate strategy.

3.2.3 Use of Currency derivatives

The Securities and Exchange Board of India (SEBI) has permitted trading in Currency Futures in exchanges to hedge the risk of the currency (USD-INR). It also allowed cross currency contracts as well on euro-dollar, pound-dollar and dollar-yen currency pairs. In the OTC market, currency forwards are available till 13 months and it is typically sold by the Banks to their customers to hedge against currency risk exposure. The entities who have issued Dollar denominated Bonds or borrowed in international market can use this market to hedge their currency risk. However, use of Currency derivatives have to factor the clear understanding of Basis Risk which is the divergence between spot and Future prices which may move in imperfect ways at times bringing in further risk.

Sample Questions:

1. Bond prices behave _____ with interest rates.
   (a) Normally
   (b) Parallel
   (c) Inversely
   (d) Equally

   Ans: (c)

2. _____ is the risk that a foreign government's actions cause a default or an adverse decline in its bond price.
   (a) Country risk
   (b) Sovereign risk
   (c) Systemic risk
   (d) Macro risk

   Ans: (b)

3. The easiest way to deal with rising prices is to invest in _____.
   (a) Inflation indexed bonds
   (b) Step up bonds
   (c) Treasury bills
   (d) Floating rate bonds

   Ans: (a)

4. Which contracts are bilateral agreements in which a party can purchase or sell assets at a certain price on a specific future date?
   (a) Forwards
   (b) Futures
   (c) Swaps
   (d) Options

   Ans: (a)

5. In an Options contract, the counterparty with an obligation to execute the option is ____.
   (a) Option buyer
   (b) Option seller
   (c) Underwriter
   (d) Settlement Agency

   Ans: (b)

CHAPTER 4: PRICING OF BONDS

LEARNING OBJECTIVES:

After studying this chapter, you should know about:

- Concept of Par Value
- Time Value of Money
- Determining Cash Flow, Yield and Price of Bonds
- Pricing of Different Bonds
- Price-Yield Relationship
- Price Time Path of a Bond
- Pricing of Floating Rate Bond

4.1 Concept of "Par Value"

"Par" is the face value of a debt instrument which is promised to be paid as principal at the maturity of the debt instrument. Typically, it is ₹100 for a Government bond but ₹10,000 for a corporate bond. This is the amount that an issuer is bound to pay back to the bond investor as per the indenture of the debt issuance. The periodic interest/coupon paid on a debt instrument is on the basis of the face value. The face Value is also known as the redemption value for a plain vanilla bond.

The market trades bonds as a percentage of face value. If a trader quotes a bid price of ₹106.35, the trader is willing to buy the security at 106.35% of the face value of the security. This convention of treating ₹100 as the face value allows easy computation of price, coupon and comparison with other bonds regardless of its type. Bonds are considered as premium ones when they trade above their face value (or par value) and are known as discount bonds when they trade below the face value. During the life of the bond (from the date of issuance to date of maturity), the bond price may move from par value to premium or discount but at the end, the bond will be pulled to the par value.

Many debt instruments are issued at a discount to the par value. Treasury Bills, Commercial Papers, etc. are always issued at a discount to the par value and the investor receives par value at maturity. The difference between the par Value and the purchase price is the capital gain/loss that the investor gets for the investment.

4.2 Time Value of Money

The Time Value of Money (TVM) is the most important analytical tool which forms the basis of many theories of finance and financial decisions. It is a mathematical notion based on the premise that the amount (e.g. ₹100 or ₹10,000) in hand is worth more than the same

amount received at a future point of time (usually after one year or later). Anything received in future will be valued less at present because of the opportunity cost involved. If an investor received the funds today, she would reinvest the same at current interest rate to get a higher value in future. Hence, the present value of an investment is always lower than the future value in a positive interest rate scenario. For example, we can look at the following two alternatives with the present interest rate of 10% p.a. for 5 years:

1. To invest ₹12,000 per year for the next 5 years (to receive its total value after this 5-year period), or
2. A single lump sum of ₹50,000 to be invested today for 5 years.

The decision to choose either of the alternatives depends on the investor's financial needs, goals, and risk taking capability. The choice is between the two options – should the investor receive a lump sum amount that looks bigger at present or receive a smaller sum periodically over the next few years. The answer to this question can be given using "Present Value" of the both cash flows. This concept is known as the "Time Value of Money" (TVM). TVM analysis helps an investor to find out the best investment option in terms of return. In our example, the first investment would be valued at ₹80,587.32 [using the Excel formula: *=FV(10%,5,-12000,0,1)*] while the second investment would be worth ₹80,525.50 [using the Excel formula: *=FV(10%,5,0,-50000,1)*], at the end of this 5 year period. The first investment thus gives a marginally higher amount to our investor in terms of future value of the investment.

Evidence of TVM comes from: (1) Interest and dividends are paid to those that give up capital over time; (2) Money received today is considered more valuable than money received later; (3) Delaying payments results in extended use of cash.

Some Common uses of TVM include:

- Determine the Present Value (PV) of cash flows to be received in future assuming a reinvestment rate, e.g. What would ₹5,000 in 5 years be worth today?
- Find out the breakeven rate of return given a maturity period for an investment.
- Find out the future value of an investment made today assuming a certain interest rate.

Simple Interest (SI) and Compound Interest (CI)

The TVM theory is rooted in the concept of interest. Simple interest is basically an interest rate without any reinvestment option. When interest is accrued for more than one period, it becomes necessary to distinguish between simple interest (SI) and compound interest (CI). Under compound interest, the money received at various points of time is reinvested to earn a higher effective rate of return. So, in effect, the simple interest rate remains static from year to year whereas the compound interest rate increases over each year.

The basic formula for simple interest is:

Simple interest (SI) = Principal * Interest rate p.a. * Time in years

The basic formula for compound interest is:

Interest for Year 1 (I_1) = Principal * Interest rate p.a. * (Time which is 1 year)

Interest for Year 2 (I_2) = (Principal +I_1) * Interest rate p.a. * (Time which is 1 year)

Interest for Year 3 (I_3) = (Principal + I_1 + I_2) * Interest rate p.a. * (Time which is 1 year)

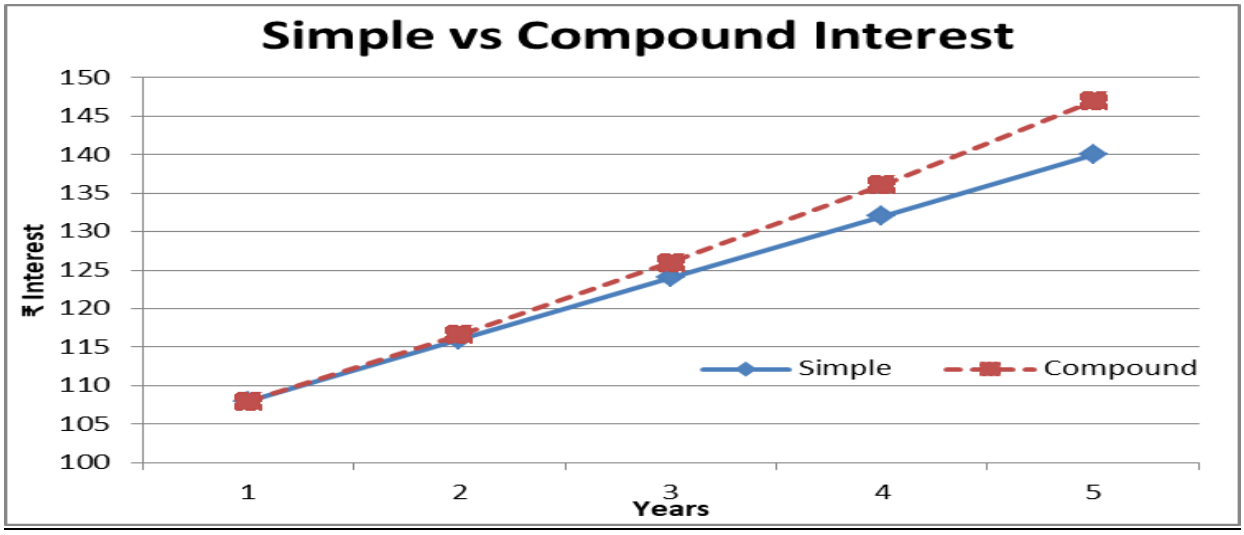
And so on……

Example: For an investment of ₹100 that earns 8% p.a., over five years, the growth in the investment would look like this:

Table 4.1 Comparison of Simple Interest and Compound Interest

	Principal at beginning of the period (₹)		Interest @ 8% (₹)		Principal + Interest at the end of year (₹)	
Year	Simple	Compound	Simple	Compound	Simple	Compound
1	100.00	100.00	100 * 8% =8	100 * 8% =8.00	108.00	108.00
2	108.00	108.00	100 * 8% =8	108 * 8% =8.64	116.00	116.64
3	116.00	116.64	100 * 8% =8	116.64 * 8% =9.33	124.00	125.97
4	124.00	125.97	100 * 8% =8	125.97 * 8% =10.08	132.00	136.05
5	132.00	136.05	100 * 8% =8	136.05 * 8% =10.88	140.00	146.93

Chart 4.1:



Single Period Investment:

When investment is made for a single period (like a year), the investor gives money today and receives the principal and promised interest at the end of that period. The investor only earns a simple interest in a single period. For example, an investment of ₹2000 at 9% for

one year would result in ₹2000+₹2000*9% = ₹2000 (1+9%) = ₹2180. This is the Future Value of the investment of ₹2000 made today at an interest rate of 9% per annum for a single period of one year.

Future Value for one period = Principal * (1 + Interest Rate %) or FV = PV (1 + r%)
where, FV = future value, PV = present value and r = periodic rate of return.

Multi-period Investment:
When multiple periods are involved in an investment, the present value would be calculated assuming reinvestment of the future stream of income at the agreed rate. If our ₹2000 is invested for 5 years, the Future Value would be ₹2000*(1+9%)^5 = ₹3077.25.

Hence, for multi-period investment:
Future Value = Principal * $(1 + \text{Interest Rate})^{\text{time}}$
or
$FV = PV (1 + r)^{t}$
where FV = future value, PV = present value, r = periodic rate of return and t = number of periods invested. Single period is a simple case of the above rule with t=1.

These calculations of future value recognize interest-on-interest (compounded interest). In the example above, the interest would have been (=₹2,000*9%*5) or ₹900, if simple interest was calculated. Instead, since interest was earned on interest, the total amount earned has become ₹1077.25, when compounding was applied.

In general, the future value of money invested for *t* years with interest credited and re-invested at the end of each year is:

$$FV = PV (1 + r)^{t}$$

The expression $(1 + r)^{t}$ represents the future value of ₹1 invested today for *t* period at a compounding rate of *r.*

For example, suppose that an investment manager invests ₹1,00,000 in a debt obligation that promises to pay 7.3% p.a. for 4 years. The future value of the ₹1,00,000 investment is ₹1,32,555.85:

$$FV = ₹1,00,000*(1+7.3\%)^{4}$$
$$= ₹1,00,000*(1.3255585)$$
$$= ₹1,32,555.85$$

The above example demonstrates the computation of the future value of an investment when interest is paid annually. When interest is paid multiple times in a year like half-yearly, quarterly, monthly, etc., we need to adjust the frequency of payment and interest rate.

$$r = \frac{\text{Interest rate p.a.}}{\text{No. of times interest paid in a year}}$$

n = No. of times interest paid in a year * number of years

In the above example, if interest is paid semiannually (i.e. paid twice in a year), then

$$r = \frac{0.073}{2} = 0.0365$$

n = 2 * 4 = 8

FV = ₹1,00,000*(1+0.0365)^{8}
= ₹1,00,000*(1.332154)
= ₹1,33,215.41

When interest is paid multiple times, the investor gets reinvestment option for the received interest and accordingly the total value of the investment increases due to the power of compounding. Hence, an investment with semiannual coupon payment would be valued more than the same investment with an annual compounding. A quarterly compounding rate fetches a much higher value. The following table explains the same:

Table 4.2:

Payment Frequency	Effective rate for 12% investment
Annul	12.00%
Semi-annual	12.36%
Quarterly	12.55%
Monthly	12.68%

Present Value

Time value of money (TVM) tells us that the money that is made available to a person today is worth more than the same amount of money to be made available to him in the future. This is mainly because the money at hand today can be invested as it has potential earning capability. Hence, money received sooner would be more valuable to the receiver than the money received later. This is the most fundamental concept in finance - money has a time value connection. In simpler terms, it is safe to say that receiving a Rupee is worth more today than receiving the same Rupee after one year.

The Present Value (PV) is the value of an investment with known future cash flows using today's market interest rate (commonly known as yield[2]) and the buyer would pay this price to buy the investment. If the investor holds the investment till maturity, then this value has no meaning to him unless he has to mark to the market the investment i.e., account for market fluctuations as per applicable regulatory requirements.

From the Future Value formula, PV can be calculated by just switching sides in the equation. If we keep the PV in the right side and move the interest rate and time component to the left hand side, then the PV computation is the inverse of future value calculation.

$$FV = PV\ (1 + r)^t$$

If we divide both sides by $(1 + r)^t$:

$$\frac{FV}{(1+\mathrm{r})\text{^}\mathrm{t}} = \frac{PV(1+\mathrm{r})^{\mathrm{t}}}{(1+\mathrm{r})^{\mathrm{t}}}$$

or

$$PV = \frac{FV}{(1+\mathrm{r})^{\mathrm{t}}} = \text{FV * PV Factor}$$

l/FV factor = PV factor.

$$PV = FV * \frac{1}{(1+\mathrm{r})^{\mathrm{t}}}$$

From the above equation, it is obvious that formula for PV is the inverse of FV. In the FV equation, using a known interest rate, the future value of today's investment is computed. In the PV equation, however, the discount rate is used to determine today's value of a future cash flow. The discounted cash flow (DCF) is arrived at, using this process of discounting an amount of future cash flow to its present value.

Present value (PV) is thus the value of money to be received in the future, expressed in today's value. In other words, PV is the amount of money that must be invested today at an interest rate of *r* per period for *t* such periods to produce a specific future value. To illustrate how this relationship works, we need to consider an investment today which would result in the maturity value of ₹10,00,000 after 5 years assuming an interest rate of 9% per annum. The present value (PV) of this investment is computed as follows:

r = 9%

t = 5

FV= ₹10,00,000

[2] Coupon is the interest rate for a security fixed on the day of issuance considering the maturity and rating class and it remains constant over the life of the security, while yield refers to today's interest rate for securities of similar rating class and maturity.

$$PV = \frac{10,00,000}{(1+0.09)^5}$$
$$= \frac{10,00,000}{1.538624}$$
$$= 649,931.39$$

The equation shows that if ₹6,49,931.39 is invested today at 9% p.a. compounded annually, the investment will grow to ₹10,00,000 at the end of 5 years. Using TVM concepts eases comparison of an investment against other investment options as well as against the price paid for its acquisition. For example, if an instrument (promising ₹10,00,000 after 5 years) is actually selling for more than ₹6,49,931.39, then it is overpriced, making the investor earn less than 9% per annum. The reverse is true, if the financial instrument is selling for less than ₹6,49,931.39.

Suppose the investor wants to find out the present value of the bond using a bond equivalent yield concept (semiannual payment) for the investment. The same would amount to:

$PV = \frac{10,00,000}{(1+\frac{9\%}{2})^{2*5}}$ = 6,43,927.68

There are two basic properties of the PV equation to be noted:

1. For any given fixed value to be received in future, higher interest rate (i.e., higher discount rate) means lower present value.
2. For any given interest rate, the present value of an investment (or a future cash flow) is lower, longer the date of maturity.

Mathematically, a bond with future known cash flows would be valued using the principal equation:

$$PV = \sum_{t=1}^{n} \frac{FV}{(1+r)^t}$$

Or, we rewrite the equation for a Bond with 100 as its final cash flow as:

$$PV = \frac{C_1}{(1+\mathrm{r})^1} + \frac{C_2}{(1+\mathrm{r})^2} + \frac{C_3}{(1+\mathrm{r})^3} + \cdots . + \frac{C_t}{(1+\mathrm{r})^t} + \frac{100}{(1+r)^t}$$

4.3 Determining Cash Flow, Yield and Price of Bonds

A bond is valued using known future cash flows. The future cash flows are calculated using the promised coupon on the Principal. We will use the above equation to price a bond. Let us assume an annual coupon paying bond with 10% interest rate promised at the time of issuance with a residual maturity of 5 years from today. Let us also assume that similar types of securities are available in the market at the yield or market interest rate of 8%. Now

we have to find the cash flows, discount factors and ultimately the price of the bond assuming a face value or par value of ₹100.

The cash flows are: Yearly ₹10 for the next 5 years and at the time of maturity, we get back ₹100 along with the last coupon. Now the Year 1 Discount Factor would be $\frac{1}{(1+8\%)^1} = 0.9259$. This means ₹1 to be received after 1 year from now would be valued ₹0.9259 today with 8% current interest rate. The same way we compute Discount Factors as follows:

Table 4.3:

Year	Discount factors using 8% Yield
1	0.9259
2	0.8573
3	0.7938
4	0.7350
5	0.6806

The Cash flows to be received in future years would be as follows along with their respective Present value using the present yield of 8% for such investment:

Table 4.4:

Year	Discount factors using 8% Yield (DF)	Cash flows (₹)	Value = DF * Cash flow (₹)
1	0.9259	10	9.2593
2	0.8573	10	8.5734
3	0.7938	10	7.9383
4	0.7350	10	7.3503
5	0.6806	110	74.8642

Now the value of the bond in our example would be sum of all discounted value of future cash flows as given in the above table. The same would work out as follows:

Table 4.5:

Year	Discount factors using 8% Yield (DF)	Cash flows (₹)	Value = DF * Cash flow (₹)
1	0.9259	10	9.2593
2	0.8573	10	8.5734
3	0.7938	10	7.9383
4	0.7350	10	7.3503
5	0.6806	110	74.8642
	3.9927		**107.9854**

The sum of all Discount Factors (3.9927) in this case would be known as PVIF or Present value interest factor. This 3.9927 is arrived using (8%,5) with annual cash flows. We can use the above PFIV to calculate the bond as follows:

Value = (Annual Coupon cash flow * PVIF) + (Par value or Face value or Redemption Value * PV of last maturity)

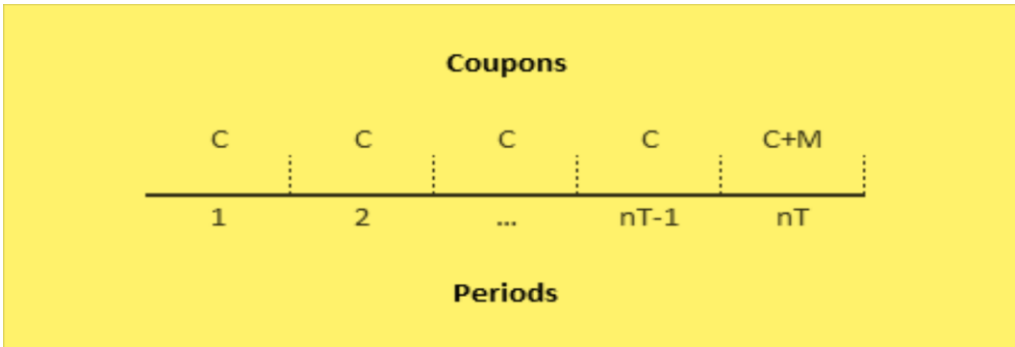
Or, Value of the Bond with 10% Coupon with 5 years maturity and present yield of 8% = (10*3.9927) + (100*0.6806) = 39.9270 +68.0600 = ₹107.9870.

4.4 Pricing of Different Bonds

Bond Cash Flows

Consider a bond paying coupons with frequency n maturing in year T. The cash flows associated with the bond are: coupon C paid with frequency n up to year T, plus the principal M, paid at T.

Chart 4.2:



We can use the same bond price equation to describe the value of a semi-annual coupon paying bond (n = 2 in this case). If the bond is paying coupon (of 10% p.a.) twice in a year, then the investor will receive only ₹5 (i.e., half of ₹10) every 6 months and the same can be reinvested at the current market interest rate of 8% p.a.

Valuation of bonds with semi-annual compounding is given in the table below:

Table 4.6:

Year	Discount Factors using 8% Yield (DF)	Cash flows (₹)	Value = Cash Flow * DF (₹)
0.5	0.961538462	5	4.8077
1.0	0.924556213	5	4.6228
1.5	0.888996359	5	4.4450
2.0	0.854804191	5	4.2740
2.5	0.821927107	5	4.1096
3.0	0.790314526	5	3.9516
3.5	0.759917813	5	3.7996
4.0	0.730690205	5	3.6535
4.5	0.702586736	5	3.5129
5.0	0.675564169	105	70.9342
SUM of DF	**8.110895779**	**Total Value**	**108.1109**

The Discount Factor for the first period is calculated as $\frac{1}{(1+4\%)^{2*0.5}}$ = 0.9615

The bond can be valued as: (coupon * PVIF) + (face value * DF for the maturity year). The same would be: (5*8.1109) + (100*0.675564) = 40.5545 + 67.5564 = ₹108.1109. The semi-annual coupon paying bond is valued more at 108.1109 than the annual coupon paying bond at 107.9870 with similar maturity, yield and coupon rate. This is due to the greater frequency of compounding in case of semi-annual bond**.**

The valuation rule for valuing semi-annual bonds can be extended to valuing bonds paying interest more frequently – like once in a quarter. Hence, if "n" is the frequency of payments per year, "t" the maturity in years, and, as before, R the present interest quoted on an annual basis, then the formula for valuing the bond would be:

$$V = \sum_{1}^{n*t} \frac{(\frac{C}{n})}{(1+\frac{R\%}{n})} + \frac{\text{Face Value}}{(1+\frac{R\%}{n})^{n*t}}$$

When n becomes very large, this approaches continuous compounding wherein the investment earns and reinvests interest at all points in time, rather than at specified intervals. However, in practice, continuous compounding gives a marginally higher interest than daily compounding and having an infinite number of periods may not be feasible.

Valuing Bonds with Maturities Less Than One Year

If a bond matures before one coupon cycle (typically a Treasury bill), then the value of the bond would be calculated as:

$$V = \frac{Face\ Value}{(1 + R\% * \frac{n}{365})}$$

This formula would calculate n as the difference between the maturity date and the date of buying the bond. However, if we have a zero coupon paper higher than one year or one coupon cycle, we can calculate the bond equivalent yield price (assuming semi-annual yield) as:

$$V = \frac{Face\ Value}{(1 + R\%/2)\text{^}(2 * time)}$$

If we want to calculate the annual bond equivalent yield, the R% would not be divided by 2 and the time would not be multiplied by 2.

For understanding these concepts, we need to understand the Day Count conventions that are very important to value a Bond. The Microsoft Excel Formula also captures the Day Count Convention while giving Price, Yield, Coupon days, etc. for a Bond. For Treasury Bills, Indian market follows "Actual/365" (this implies the difference of days between two

calendar days and the year is considered as having 365 days) while for Government Bond market, we follow "30/360E" (this means each month is considered as 30 days and year is considered as having 360 days).

Valuing Bonds at Non-Coupon Dates

The Dirty Price is nothing but the Present Value of the Bond. The Present value is further bifurcated into Clean Price and Accrued Interest. Bonds are generally valued in between coupon dates when they are traded. Hence the concept of Clean price and Dirty price has to be established. The dirty price is the sum of clean price and the interest accrued on the bond since the last coupon payment date.

Dirty Price = Clean Price + Accrued Interest

The Accrued interest is a simple calculation of interest amount in Rupee value using the Coupon Rate for the number of days it has accrued from the last coupon payment date. Coupons are paid every half-year for Government Bonds. Interest part gets accrued from the last payment date and would be paid on next coupon date. Since, there is no reinvestment option for this coupon between the last coupon date and the next coupon date or the sale date of the bond, the accrued interest is not discounted like the future coupons.

Hence, in this formula, the accrued interest is not discounted as there is no intervening cash flow before the first coupon to be received after an investor buys the bond. As per market convention, the amount the buyer would pay to the seller is the clean price plus the accrual interest. This amount is often called the dirty price, full-price or invoice price. The price of a bond excluding accrued interest is called the clean price. The market typically trades a bond on the basis of clean price. All yield, and price formulas are on the basis of clean price. The following holds good in case of Indian fixed income securities market:

- Bid/Ask prices for the trading are quoted using Clean Price
- Settlement of a trade is done using Dirty Price
- Yields are computed using Clean Price

In order to price a bond in between coupon days, the following principles are followed.

1. Take the settlement date (buying date) to the previous coupon date and value the bond using the coupon, yield and the residual maturity from the last coupon date.
2. Bring the said price or value to the future date (settlement date or buying date) with a Future Value Factor.
3. Deduct the accrued interest from the total value to arrive at the clean price or trade price or invoice price.

Example:
Trade value (Settlement) date: 12-Aug-2020
Maturity date: 11-May-2030
Coupon: 5.79%
Present yield: 5.90%.
The bond pays semi-annual coupon.
The market convention for day count is “30/360 European” (i.e., every month is 30 days and year is 360 days).

Last coupon Date: = 11-May-2020
Time from 11-May-2020 to 11-May-2030 = 10 years
Time between Last coupon date (11-May-2020) and Settlement date (12-Aug-2020) = 91 days = 91/360 years = 0.252778 years (using 30/360E day count rule).

Price of the bond on last coupon date (11-May-2020) with 5.90% yield would be ₹99.1779. The same is arrived at by using the PVIF of 14.94648 for half of the coupon (2.895*14.94648 = 43.27007) and face value ₹100 multiplied by the PV factor or Discount Factor of last maturity (100*0.5590787 = 55.90787). The total of ₹43.27007 and ₹55.90787 works out to be ₹99.1779 for our bond.

Present interest rate being higher than the coupon makes this bond a discount bond at the moment.

Now we will use the Future value factor to determine the value of this Bond at the settlement date taking the value of 11-May-2020 to 12-Aug-2020 using the yield of the Bond at 5.90% for 91 days. This would give us the Dirty Price of the bond at the settlement date

$$\text{Dirty Price} = 99.1779 * \left(1 + \frac{5.90\%}{2}\right)^{(0.252778*2)}$$ = ₹100.6464.

Now for 91 days, the accrued interest will be

$$\text{Accrued Interest} = 5.79 * \left(\frac{91}{360}\right) = ₹1.4636$$

Deducting accrued interest from the dirty price will provide the clean price of the bond.
Therefore, clean price of this bond would be: ₹100.6464 – ₹1.4636 = ₹99.1828.

This bond would be quoted and traded at a clean price of ₹99.1828 and will be settled at the Dirty Price of ₹100.6464. The same value can be arrived by using every stage cash flow discounting, as shown below:

Table 4.7:

Settlement date	Cash Flow date	Cash Flow	Maturity	DF @5.90%	D Value
12-Aug-20	11-Nov-20	2.895	0.2472	0.9857	2.8537
	11-May-21	2.895	0.7472	0.9575	2.7719
	11-Nov-21	2.895	1.2472	0.9300	2.6925
	11-May-22	2.895	1.7472	0.9034	2.6153
	11-Nov-22	2.895	2.2472	0.8775	2.5404
	11-May-23	2.895	2.7472	0.8524	2.4676
	11-Nov-23	2.895	3.2472	0.8279	2.3969
	11-May-24	2.895	3.7472	0.8042	2.3282
	11-Nov-24	2.895	4.2472	0.7812	2.2615
	11-May-25	2.895	4.7472	0.7588	2.1967
	11-Nov-25	2.895	5.2472	0.7370	2.1337
	11-May-26	2.895	5.7472	0.7159	2.0726
	11-Nov-26	2.895	6.2472	0.6954	2.0132
	11-May-27	2.895	6.7472	0.6755	1.9555
	11-Nov-27	2.895	7.2472	0.6561	1.8995
	11-May-28	2.895	7.7472	0.6373	1.8451
	11-Nov-28	2.895	8.2472	0.6191	1.7922
	11-May-29	2.895	8.7472	0.6013	1.7408
	11-Nov-29	2.895	9.2472	0.5841	1.6910
	11-May-30	102.895	9.7472	0.5674	58.3782
			SUM	15.16779	**100.6464**

Let us consider another example of a bond issued by Government of India "7.27% GS 2030" with maturity date 05-May-2030 and paying annual coupon of 7.27% on semi-annual basis, priced in between two coupon dates on 06-Jul-2020 and trading for annual yield of 6.50%. The day count convention followed for government bonds in India is European 30/360 basis i.e., each month is to be taken as having 30 days and each year is to be taken as having 360 days, irrespective of the actual number of days in the month. When using Microsoft Excel, the formula used is =DAYS360(). The future cash flows of the bond are discounted at the prevailing yield to arrive at the present value of the bond. By adding all discounted cash flows (DCF), we get the dirty price of the bond.

We can arrive at the value using Excel and the same can also be explained as above. The coupon is 3.635 per payment date starting with 05-Nov-2020 and would end in 05-May-2030 while we are valuing the Bond on 06-Jul-2020. The Discount Factor or PV factor summation from 05-Nov-2020 to 05-May-2030 is 14.69775 and the last PV Factor which will be used for the Maturity Value of 100 is 0.53322. Hence the Dirty Price or the Present Value would be = 14.69775 * 3.635 +100 *0.53322 = 106.7484. The Accrued interest for 61 days would be 7.27*(61/360) = 1.2319. Accordingly, the Clean Price is arrived at 105.5166.

Table 4.8:

Settlement	Cash Flow Date	Cash Flow (₹)	Time	DF @ 6.50%	DCF
06-Jul-20	05-Nov-20	3.635	0.3306	0.9791	3.5589
	05-May-21	3.635	0.8306	0.9483	3.4469
	05-Nov-21	3.635	1.3306	0.9184	3.3384
	05-May-22	3.635	1.8306	0.8895	3.2333
	05-Nov-22	3.635	2.3306	0.8615	3.1316
	05-May-23	3.635	2.8306	0.8344	3.0330
	05-Nov-23	3.635	3.3306	0.8081	2.9375
	05-May-24	3.635	3.8306	0.7827	2.8451
	05-Nov-24	3.635	4.3306	0.7580	2.7555
	05-May-25	3.635	4.8306	0.7342	2.6688
	05-Nov-25	3.635	5.3306	0.7111	2.5848
	05-May-26	3.635	5.8306	0.6887	2.5034
	05-Nov-26	3.635	6.3306	0.6670	2.4246
	05-May-27	3.635	6.8306	0.6460	2.3483
	05-Nov-27	3.635	7.3306	0.6257	2.2744
	05-May-28	3.635	7.8306	0.6060	2.2028
	05-Nov-28	3.635	8.3306	0.5869	2.1334
	05-May-29	3.635	8.8306	0.5684	2.0663
	05-Nov-29	3.635	9.3306	0.5505	2.0012
	05-May-30	103.635	9.8306	0.5332	55.2602
				Dirty Price	106.7484
			Less	Accrued Interest	1.2319
				Clean Price	105.5166

The Dirty Price or the invoice price or the full value price of the Bond is ₹106.7484. It has two parts in the books of the holder, as the accrued interest (₹1.2319) is taken to profit and loss account while the asset price (clean price of ₹105.5166) goes to the balance sheet as an asset. The Clean price is the quoted price of the Bond.

Perpetual Bond Pricing

A perpetual bond is an instrument that continuously pays the agreed coupons but it never pays the face value and has no maturity date affixed to the bond. For a simple perpetuity paying regular coupons, the payment is the same as the interest payment of the one-year bond. Hence, a perpetual bond is an instrument issued without any finite maturity date. Perpetual bonds promise to pay coupon indefinitely as the issuer is not bound to pay back the principal. Hence, the value of a perpetuity would be calculated as:

$$PV = \frac{Coupon}{Yield}$$

If coupon of a Perpetuity is 8% on a face value of ₹100 and if the investor would like to have an annual yield of 6%, then this perpetuity would be valued as (100*8%)/6% = ₹133.33.

Treasury Bill Pricing

Treasury Bills in India are money market instruments to finance the short-term requirements of the Government of India. These instruments follow a day count convention of the Actual/365 unlike Bonds which follow 30/360 convention. The return an investor gets is calculated as the difference between the maturity value or face value (₹100) and issue price. The price of a treasury bill (T-Bill) can be calculated as:

$$P = \frac{100}{\left(1 + r * \frac{\text{Days to Maturity}}{365}\right)}$$

Treasury bill yield is a discount yield. In order to compare the discount yield on T-bills to a bond's investment yield, the discount rate is converted into its semi-annual-coupon paying equivalent. The formula used for the conversion of this discount yield of a T-bill to the bond equivalent yield (BEY) is:

$$\text{BEY (T-Bill)} = (365 \times DY) / [360 - (t \times DY)]$$

where DY is the discount Yield and t the number of days to maturity from the date of valuation.

Discount Factors (DF) and Bootstrapping

The interest rate or the yield rate is known as the one-year zero-rate, if the bond pays a bullet cash flow at maturity with no interim cash flow. The discount factor for *t* years is written as d(t). So, for example, if d(0.5) =0.9569, the present value of ₹1 to be received in six months is ₹0.9569. A discount factor is the ratio of PV to FV for a given zero-rate and time to maturity.

$$Discount\ Factor\ (DF) = \frac{PV}{FV} = \frac{1}{(1+r)^t}$$

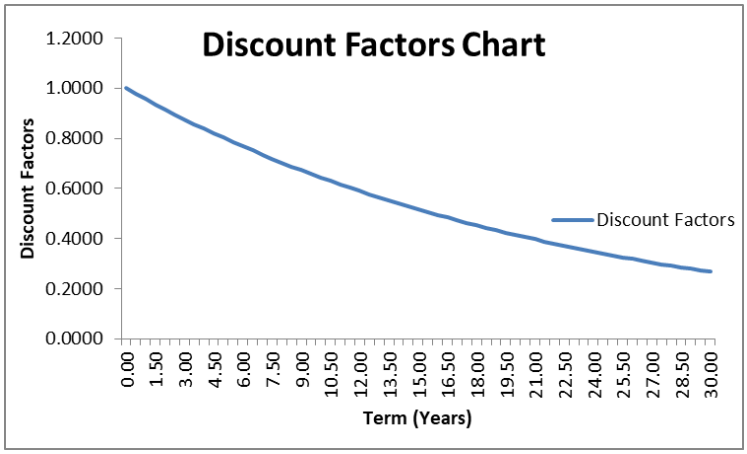
As an example, Discount factors for an interest rate of 9% p.a. are given below:

Table 4.9:

Year	Discount Factors	Year	Discount Factors	Year	Discount Factors	Year	Discount Factors
0.00	1.0000	8.00	0.4945	16.00	0.2445	24.00	0.1209
0.50	0.9569	8.50	0.4732	16.50	0.2340	24.50	0.1157
1.00	0.9157	9.00	0.4528	17.00	0.2239	25.00	0.1107
1.50	0.8763	9.50	0.4333	17.50	0.2143	25.50	0.1059
2.00	0.8386	10.00	0.4146	18.00	0.2050	26.00	0.1014
2.50	0.8025	10.50	0.3968	18.50	0.1962	26.50	0.0970
3.00	0.7679	11.00	0.3797	19.00	0.1878	27.00	0.0928

3.50	0.7348	11.50	0.3634	19.50	0.1797	27.50	0.0888
4.00	0.7032	12.00	0.3477	20.00	0.1719	28.00	0.0850
4.50	0.6729	12.50	0.3327	20.50	0.1645	28.50	0.0814
5.00	0.6439	13.00	0.3184	21.00	0.1574	29.00	0.0778
5.50	0.6162	13.50	0.3047	21.50	0.1507	29.50	0.0745
6.00	0.5897	14.00	0.2916	22.00	0.1442	30.00	0.0713
6.50	0.5643	14.50	0.2790	22.50	0.1380		
7.00	0.5400	15.00	0.2670	23.00	0.1320		
7.50	0.5167	15.50	0.2555	23.50	0.1263		

Chart 4.3:



The set of discount factors is known as the discount function. The discount factors help us to price the present value of a cash flow to be received in future. In addition, discount factors may also be used to calculate the future value of any present investment. From the example above, ₹0.9569 would be worth ₹1 in six months' time, so by the same principle a present amount of ₹1 would be worth ₹1.0450 (= ₹1 * (1 / 0.9569)) at the end of six months. This is because inverse of discount factor is future value factor.

It is possible to obtain discount factors from current bond prices. Suppose we have the following bonds maturing in different times and we want to value the same on 12-Aug-2020.

Table 4.10:

Coupon	Maturity	Price (₹)
8.75	12-Feb-21	101.92
6.09	12-Aug-21	100.63
6.07	12-Feb-22	99.87
8.33	12-Aug-22	102.89

From the first bond that matures in six months and we will receive 104.3750 at the end of the six months. (₹4.375 final coupon and the ₹100 redemption payment). To obtain this, we are paying the Present Value of ₹101.92. The implied discount factor would be =101.92 / 104.375 = 0.976479.

$$d(0.5) = \frac{101.92}{104.375}$$
$$= 0.976479$$

The second bond would give us

- ₹3.045 in six months
- ₹103.045 in one year

The price quoted for this bond is ₹100.63. The coupon 3.045 would be received after 6 months and its value would be 3.045 * 0.976479 = 2.9734. The final coupon and maturity value would be 103.045 to be received in one year's time. We can calculate the d(1) from the equation as below:

₹100.63 = 3.045 * d (0.5) + 103.045 *d (1)

₹100.63 = 3.045 * 0.976479 + 103.045 * d (1)

₹100.63 = 2.9734 + 103.045 * d (1)

$$\frac{100.63 - 2.9734}{103.045} = d(1)$$

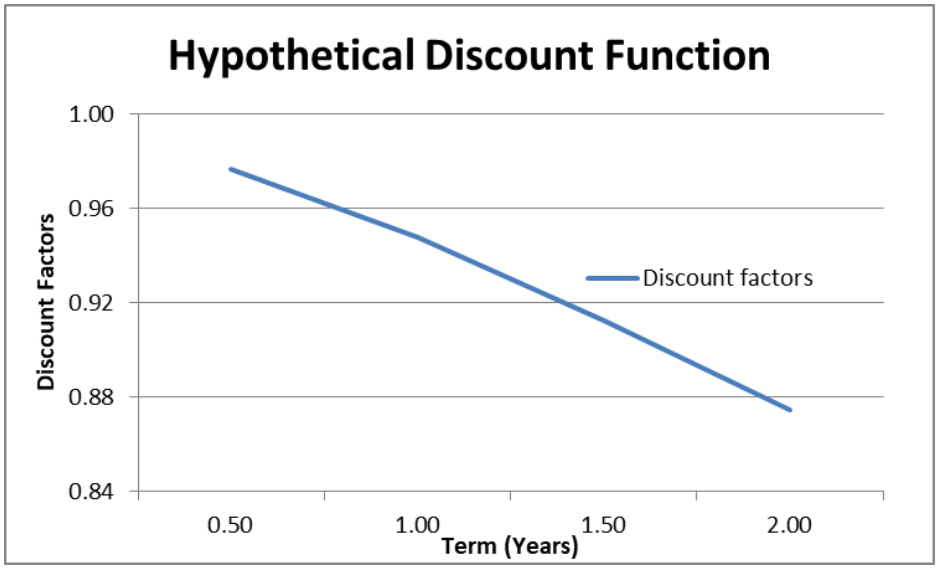
$$0.947708 = d(1)$$

We can get the implied yield using the simple formula 2*(1/d(t))^(1/2*t)-1) or ((1/0.976479)^(1/(2*.5))-1)*2 = 4.81% (rounded off to 4.8% in the Table). Carrying on with this procedure for the remaining two bonds, using successive discount factors, the complete set of discount factors is obtained which is given below:

Table 4.11:

Coupon	Maturity	Term (Years)	Price (₹)	d(t)	Implied rate
8.75	12-Feb-21	0.5	101.92	0.976479	4.8%
6.09	12-Aug-21	1.0	100.63	0.947708	5.4%
6.07	12-Feb-22	1.5	99.87	0.912603	6.2%
8.33	12-Aug-22	2.0	102.89	0.874332	6.8%

Chart 4.4:



This is known as boot strapping of the discount factors from the bond prices at a given point in time.

Interpolation

Market quotes the rates for standard maturities. Hence, traders calculate interpolated rates for non-standard maturities using straight line interpolation, which apportions the difference equally among the stated intervals.

$$Rn = R1 + \frac{R2 - R1}{T2 - T1} * (Tn - T1)$$

Here, R1 = Known rate with short maturity
T1 = Days to maturity of R1
R2 = Known rate with long maturity
T2 = Days to maturity of R2
Rn = Unknown rates between R1 and R2
Tn = Days to maturity of Rn

Interpolation provides rates quite close to theoretical ones if R1, R2 and Rn are close to each other.

4.5 Price-Yield Relationship

The price-yield relationship is inverse in nature. When we calculate the relationship, we use only the clean price. If we want to plot the price-yield relationship of two bonds, we can compare their relative effective riskiness.

Chart 4.5:

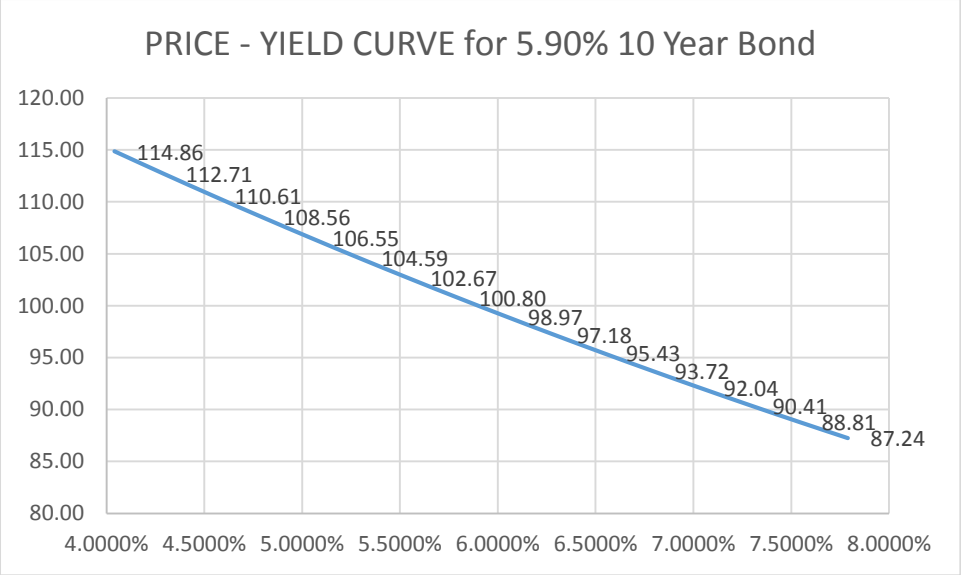
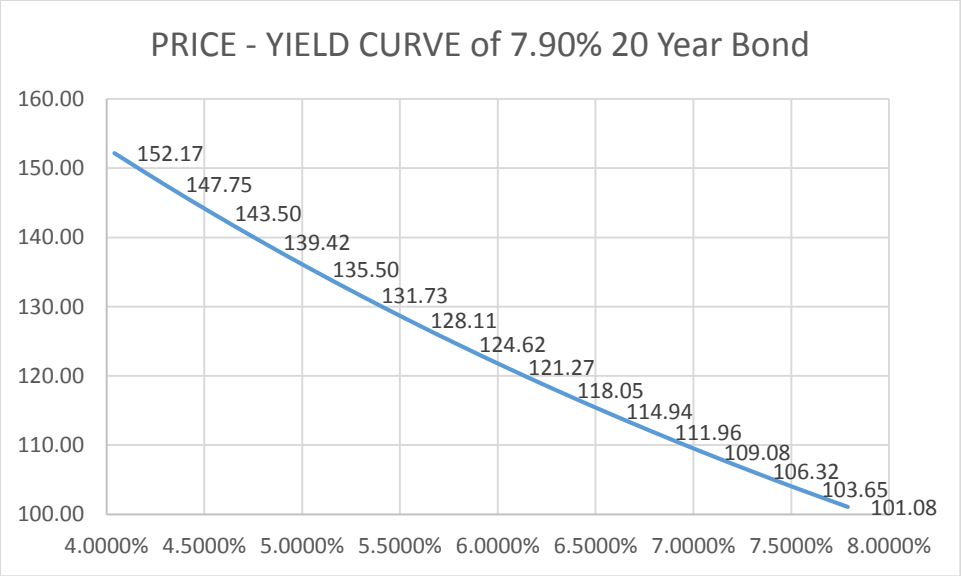


Chart 4.6:



While the price-yield relationship will be discussed in detail in later chapters, it can be summarized here as follows:

1. The inverse relation between a bond's price and rate of return is given by the negative slope of the price-yield curve. The movement across the curve is non-linear.
2. The bond with larger maturity time would have higher sensitivity to interest rate changes.
3. The lower a bond's coupon rate, the greater is its price sensitivity.

Relation between Coupon Rate, Required Rate, value, and par value

Bonds can trade at par when the coupon and yield are same. But, if the Coupon is lower than the current market yield, then the bond would be trading at discount. If the coupon is higher than the current market yield, it would be trading at premium.

Bond-Price Relation 1:	if $C^R = R \Rightarrow V_o^b$ = F: Bond valued at par. if $C^R < R \Rightarrow V_o^b <$ F: Bond valued at discount. if $C^R > R \Rightarrow V_o^b >$ F: Bond valued at premium.

When the required rate increases, the price of the bond falls as can be seen in the table:

PRICE-YIELD RELATION

10-Year, 9% Annual Coupon Bond

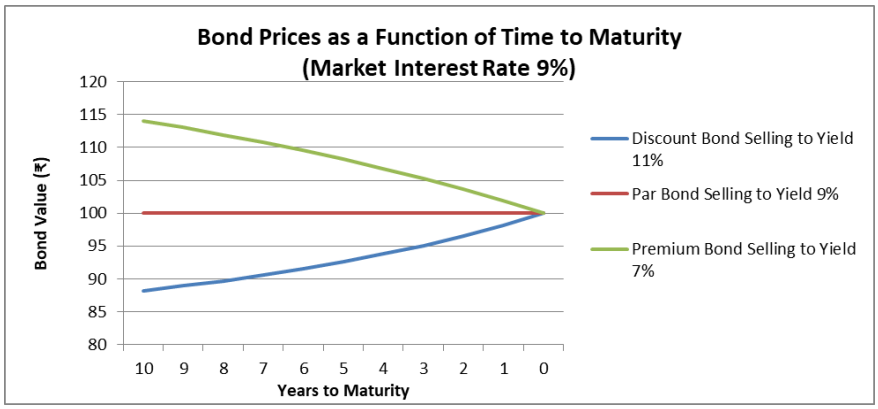
Required Rate	Bond Value (₹)	Changes in Bond Value (₹)
5%	130.89	
6%	122.08	-8.807
7%	114.05	-8.032
8%	106.71	-7.337
9%	100.00	-6.710
10%	93.855	-6.145
11%	88.222	-5.633
12%	83.049	-5.173
13%	78.295	-4.754

4.6 Price Time Path of a Bond

The Value Over Time of an Original 10-Year, 9% Annual Coupon Bond Selling at Par, at Discount, and at Premium:

	Discount Bond	Par Bond	Premium Bond
	Price of Bond (₹)	Price of Bond (₹)	Price of Bond (₹)
Year	Selling to Yield 11%	Selling to Yield 9%	Selling to Yield 7%
10	88.2220	100.00	114.05
9	88.9260	100.00	113.03
8	89.7080	100.00	111.94
7	90.5760	100.00	110.75
6	91.5390	100.00	109.53
5	92.6080	100.00	108.20
4	93.7950	100.00	106.77
3	95.1130	100.00	105.25
2	96.5750	100.00	103.62
1	98.1980	100.00	101.87
0	100.0000	100.00	100.00

Chart 4.7:



The price path of a bond tells us the importance of "Pulled to Par" concept.

4.7 Pricing of a Floating Rate Bond

A floating rate bond (FRB) is a bond with a coupon that is indexed to a benchmark interest rate (generally a short-term interest rate). The basic semi-annual coupon FRB in India has the coupon indexed to the 6-month interest rate (182-day T-Bill rate). Only the next coupon is known at the current date. The later ones are randomly set by the future 6-month interest rates. Each coupon is based on the previous 6-month rate. The price reverts to par on the coupon refixation day. In other words, an FRB is always worth par on the next coupon date with certainty. The pricing of FRB involves discounting the principal and the next coupon payment using today's interest rates, similar to fixed rate securities.

Sample Questions:

1. Which instrument is a discounted instrument at the time of its issue?
   (a) Government Bonds
   (b) Corporate Bonds
   (c) PSU Bonds
   (d) Treasury Bills

   Ans: (d)

2. What will be the closest investment to make today to earn Rs 1,00,000 after 10 years assuming a continuous compound interest rate of 9%?
   (a) Rs 64,993
   (b) Rs 1,53,862
   (c) Rs 2,36,736
   (d) Rs 42,241

   Ans: (d)

3. What will be the PVIF, if the required rate is 10% compounded semi-annually for 2 years of maturity?
   (a) Rs 3.71
   (b) Rs 3.55
   (c) Rs 3.98
   (d) Rs 3.63

   Ans: (b)

4. A T-Bill with 65 days of remaining maturity is selling at 98.65% of its Face Value. What is the money market yield of the security (follow day convention of Actual/365)?
   (a) 7.68 percent
   (b) 1.35 percent
   (c) 8.24 percent
   (d) 9.25 percent

   Ans: (a)

5. What is the Bond Equivalent Yield of a 91-Day Treasury Bill on issuance date with a cut off yield of 5.75%?
   (a) 5.92 percent
   (b) 5.46 percent
   (c) 5.64 percent
   (d) 5.29 percent

   Ans: (a)

CHAPTER 5: YIELD MEASURES AND TOTAL RETURN

LEARNING OBJECTIVES:

After studying this chapter, you should know about:

- Sources of Return
- Traditional Yield Measures

An investor who is parting with her money, would postpone the present consumption to a future date. The future value of her consumption is likely to be more, if we take into account the expected inflation. Further, the investor is also taking a risk against the counterparty, as the borrower may not return the borrowed funds. Hence, the investor expects to receive some income or return commensurate with the risk or the opportunity loss. The return from an investment is the compensation for the risk borne by the investor by taking exposure to that investment. In case of a debt security, lenders lending money to the borrowers seek return for transfer of funds from savings to debt. The returns on these investments, when annualized in percentage terms, are known as the "yield" or "interest rate" earned from these investments. These standardized measures help in comparing the different investment alternatives available to the investors. The periodicity of receipt of promised cash flows from the bond or investment also influences the return percentage, as compounding rules and reinvestment opportunity brings an expected higher annualized return.

Financial markets facilitate the transfer of funds from lenders to borrowers, or from savers to investors, or from buyers to sellers. The funds are allocated in terms of the investment objectives of the savers and risk the investment embodies. Financial risk is an inherent part of the investment and some investments are more risky as the chance of recovery of both principal and promised interest return drops when the risk increases. The credit rating associated with a bond tells us about the relative riskiness of the instrument in the sense that the possibility of performance of the promise is high for higher rated bonds and low for lower rated bonds.

Rate of return for a fixed income investment may be explained by the present market yield for similar kind of instruments, coupon rate on the investment, the current yield, or even the discount yield. If an investor invests in short term instrument (less than one year maturity), the income is expressed in terms of discount yield. For example, we invest in Treasury Bills and on maturity we get only the Face value of 100. But we pay less than 100 at the time of purchase. Here the return is expressed as a Discount Yield. The market yield is the interest rate offered on an instrument typically using Bond market Convention. It is more often called as "Yield to Maturity". In comparison to Market Yield or YTM, the Current Yield is a measure used by traders to understand the relative attractiveness of the

investment for one coupon cycle. It is typically given as Annual Coupon divided by Clean Price of the Bond. When we say “interest rate”, it means what an investor is willing to receive (like in the form of a regular coupon) for taking the risk of buying the instrument (or, what the lender is willing to accept in return for the loan given to the borrower). The cost of borrowing is always calculated in terms of percentage in reference to the Principal amount.

Price of a Fixed Income Security is calculated on the basis of certain market conventions. These conventions include coupon frequency, day count convention, holiday treatment (In India, if the maturity date of the security corresponds to a holiday, the payout for redemption will happen on previous day for instruments like treasury Bills and Government Bonds but if any coupon falls due on a holiday, it would be paid only on next business day). Each market geography has a handbook explaining such market conventions. In India, FIMMDA handbook is widely used by traders to interpret the price and yield quoted in the market. This unit discusses common measures of rate of return for fixed income instruments and bonds.

5.1 Understand the Sources of Return

Fixed income investors or investors who purchase a bond may benefit from that investment in many ways:

- periodic coupon as per the terms in the indenture of the bond;
- capital gain if interest rate falls (it may also result in capital loss if interest rate rises), in case the instrument is traded before maturity;
- reinvestment of the cash flows received during the life of the bond (akin to interest on interest).

5.1.1 Coupon Income

A coupon income is the regular flow of money or return to the investor or lender as promised by the borrower. When we say, for example, 7% GS 2027, we mean the security is a Government Security, paying an Annual Coupon of Rs 7 on a Face value of Rs 100. Typically, the coupons are paid semi-annually and hence, the investor would receive the coupon of Rs 3.50 every half year.

Coupon is the promise of the borrower to pay a certain amount of money at regular intervals to the lender during the life of a bond or a note. In earlier years, bonds issued by Governments or central banks on behalf of sovereign Governments used to be bearer bonds and were repaid on physical presentation of the appropriate instrument. Smaller tokens/coupons used to be attached to such bearer bonds indicating a specific amount that was payable on a specific date mentioned on such tokens/coupons so that investors could collect the same on physical presentation of those tokens/coupons. The coupon used to be fixed for the bearer bonds. Bond coupons are the biggest source of income for the bond

holders. As per indenture, the specified yearly coupon amount is typically paid semi-annually.

Indenture of Government Bond 7.17% GS 2028 (08-Jan-2028) specifies coupon payment twice in a year on 08-Jan and 08-July till it matures on 08-Jan-2028. An investor will receive Rs 3.585 (i.e., half of Rs 7.17) on every coupon date per each bond held. Rs 7.17 is calculated using the face value of Rs 100 (i.e., as 7.17% p.a. on Rs 100).

A Zero Coupon Bond investor doesn't receive any coupon during the investment period. At the end of the investment period, investor will receive the face value Rs 100. In India, GoI treasury bills are issued as Zero Coupon Bonds.

If the bond buyer buys a Floating rate bond linked to a benchmark like 182-Day T-Bills, the investor would receive varying coupons depending on the interest rate paid on a 182-day T-Bill on the coupon date.

5.1.2 Capital appreciation

During the life of investment in a bond, market interest rate changes and the present value of the Bond would also change as the Coupon is fixed. If the investor holds till maturity, her rate of return would remain fixed but if the investor desires to exit the investment anytime during the life of the bond, her investment would either gain in value (if the present market interest rate has fallen vis-à-vis promised Coupon) or it would have reduced in value (if the present market interest rate has gone up). There will be capital appreciation during the life of the bond, if the interest rate in the market falls and the original investor sold the bond at such times, though at maturity the return would be only the face value.

Typically, Coupon is set on the issuance date based on the interest rate prevailing in the market for a particular class of bonds with a particular maturity. For example, the issuer issuing the AAA rated bond of 10 years maturity would pay the interest rate prevailing in the market on the date of issue for similar kind of bonds. After issuance, changes in the economic scenario do make the interest rate change. If the interest rate rises, the market value of the investment would come down and if the interest rate falls, the market value of the instrument would increase. This fall / rise in market value is a capital depreciation / appreciation of the bond, if it is sold during this time before maturity. If the bond is held till maturity, this interim fall and rise of interest rate would have no meaning for the investor. Appreciation and depreciation in value of the bond is very important to traders as their investment has to be recorded in their books of accounts as per the market value of the bond.

If our investor of 7.17% GS 2028 faces the interest rate changes lower than 7.17%, the bond would be selling at a price higher than Rs 100 in the market. Therefore, the investor would

make a gain out of this bond when interest rate falls below 7.17% but the investor would make loss, if the interest rate rises above 7.17%. The rule is when interest rate falls, the investor gains but when interest rises, the investor faces loss.

Further, long term bonds pay a term premium. The term premium is the amount by which the yield on a long-term bond is greater than the yield on shorter-term bonds. This premium reflects the amount investors expect to be compensated for lending for longer periods (and therefore longer periods of uncertainty). We can take the differences between the long term and short term yields (difference between 10 year and 3 Month yield) to measure the term premium.

5.1.3 Reinvestment income

The investor receives periodic interest or coupon on the debt investment. The same is reinvested on assets which would yield further income. For example, when a semi-annual coupon payment is received by our investor from the investment on 7.17% GS 2028, the investor would have the ability to invest that cash flow of Rs 3.585 in another asset on such coupon receiving date. The yield to maturity (YTM) assumes the reinvestment of the future coupons at the same rate (i.e., at YTM). This is because the bond price equation assumes the same yield to discount all future cash flows (i.e., both the coupons and the redemption value).

5.2 Traditional Yield Measures

Bonds exhibit various characteristics with respect to being securities as below:

- Different maturities with the same coupon
- Different coupons for the same maturity
- Different ratings for the same coupon and maturities
- Different redemption values with varied maturity

These characteristics affect price of the bonds in a very explicit way. Price of a bond cannot be used to compare the relative attractiveness with another bond because of the above reasons. Bonds' price does not give much information to the investors. If a bond maturing in 10 years of time with a coupon of 10% trades at Rs 117.37 and another bond with 10-year maturity with a coupon of 8% trading at Rs 103.47 and still another bond of 10-year maturity with 6% coupon trading at Rs 89.58, the investor gets the same return of 7.5% p.a., when converted into implied yield from their prices, given maturity and the coupons, assuming the above three bonds belong to the same rating class. The returns on investment on bonds have to be compared using a unified measure like the yield an investor gets from such bonds. Yields can be compared to find out the relative attractiveness of various investments. For an investor, yield of a bond also provides information about the bond being fairly valued.

"Yield" is the interest rate that would make present value of the known future cash flows of the bond equivalent to the current price of the bond. We know the equation:

$$PV = \sum_{n=1}^{N} \frac{C_n}{(1+r)^n} + \frac{Redemption\ Value}{(1+r)^n}$$

C_n is the future known cash flows (at various future dates) of the bond over "n" years;
PV = Initial value we agree to pay for the Bond or Price of the Bond (all inclusive);
N = number of years 1 to N.

In MS Excel, we can use the PRICE formula which is written as:
=PRICE(START_DATE,END_DATE,COUPON,YIELD,FACE_VALUE,FREQENCY,DAY_COUNT)
to get the Value of the Bond. The yield "r" calculated from the above relationship is also known as the "Internal Rate of Return" as this is used to discount all future known cash flows to get the current price of the bond.

In general, the yield can be explained in three ways. The most widely observed yield is known as the "Yield to Maturity" (or, YTM) which is commonly referred to as "Yield" in the market. For any bond traded in the market, the YTM is derived assuming that the investor would hold the bond until maturity and all future interest rates would be remaining the same as the discount rate so that all future coupons when received in future would be reinvested at the same Yield.

The second definition of yield is observed for Treasury bills and STRIPS (zero coupon papers) is the "Spot Yield" or Zero Coupon Yield. Further, if a good number of STRIPS are not traded in the market, the Spot yield is typically derived from traded bonds or by using a Par Curve through Bootstrapping techniques or by using various Models like Cubic Spline, Nelson Siegel, etc.

The third yield is a "Forward Yield" which is an implied forwards yield derived from the series of Spot yields assuming no-arbitrage investment behaviors of the investors.

The simple bond yield, also called coupon rate, is calculated by dividing its interest payment by the face value of the bond.

$$\text{Coupon Rate} = \frac{\text{Annual Interest Payment by the bond}}{\text{Bond Face Value}}$$

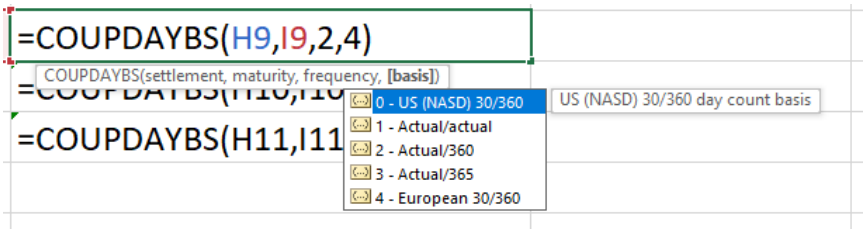
For a bond with face value of ₹100 making coupon payments of ₹10 per year, the coupon rate is 10% (₹10/₹100 = 10%).

Bonds are traded at clean price in the market. Traders quote yield (rate) or the price of the bond for trading purpose. But, at the time of settlement, the seller receives full value of the

bond (Dirty Price) including accrued interest till the date of transfer of the bond to the buyer. The formula for determining accrued interest is:

$$\text{AI} = \text{Coupon} * \frac{\text{Days from last coupon}}{\text{Days between last coupon and next coupon}}$$

In calculating the accrued interest, the ratio of days since last coupon date to the days between coupon dates depends on the day count convention specified in the bond contract. We can also get the Accrued Interest by using the Excel Formula: AI = COUPON * (COUPDAYSBS / 360).



COUPDAYSBS formula above calculates the broken period for which interest has accrued from the last coupon date till the settlement date. One of the variables in COUPDAYSBS formula is Day Count Basis. A particular market will apply one of the following methods to calculate accrued interest:

1. Actual/Actual: AI = Coupon * (days / actual number of days in the interest period)
2. 30/360E: AI = Coupon * (30/360)
3. Actual/360: AI = Coupon * (days/360)
4. Actual/365: AI = Coupon * (days/365)

1. Actual/Actual day counting: This takes into account the actual number of days between the last coupon date and the next coupon date. This is very helpful for the Leap year when we have one day more for the year. For example, in the case of a 6.90% bond paying semiannually, whose previous coupon date was the January 13, 2021 and next coupon date is July 13, 2021, the accrued interest on March 5, would be:

$$\text{AI} = \frac{6.90}{2} * \frac{51}{181} = 0.972099$$

2. 30/360E Day Counting: This day count convention considers all months are equal and have fixed 30 days in a month and 360 days in a year. This is widely used in Bond market. Day count conventions can be explained as follows for Indian bond market:

$$Day\ count\ Fraction = \frac{[360 * (Y2 - Y1)] + [30 * (M2 - M1) + (D2 - D1)]}{360}$$

where:

"Y1" is the year pertaining to the year of the start date (last coupon date);

"Y2" is the year pertains to the year of the end date (settlement of cash flow date or next coupon date);

"M1" is the calendar month pertaining to the start date (last coupon date);

"M2" is the calendar month pertaining to the end date (settlement of cash flow date or next coupon date);
"D1" is the first calendar day, expressed as number, of the Calculation Period or Compounding Period, unless such number would be 31, in which case D1 will be 30; and
"D2" is the calendar day, expressed as a number, immediately following the last day included in the Calculation Period or Compounding Period, unless such number would be 31, in which case D2 will be 30.

We also have another 30/360 (Nasdaq). This helps to cover the bonds issued after 28th of August but before 01-Sep. This is given as follows:

$$Day\ count\ Fraction = \frac{[360 * (Y2 - Y1)] + [30 * (M2 - M1) + (D2 - D1)]}{360}$$

where:
"Y1" is the year pertaining to the year of the start date (last coupon date);
"Y2" is the year pertains to the year of the end date (settlement of cash flow date or next coupon date);
"M1" is the calendar month pertaining to the start date (last coupon date);
"M2" is the calendar month pertaining to the end date (settlement of cash flow date or next coupon date);
"D1" is the first calendar day, expressed as number, of the Calculation Period or Compounding Period, unless such number would be 31, in which case D1 will be 30; and
"D2" is the calendar day, expressed as a number, immediately following the last day included in the Calculation or Compounding Period, unless (i) that day is the last day of February but NOT the termination date or (ii) such number would be 31, in which case D2 will be 30.

In the case of the 6.90% bond paying semiannually, whose previous coupon date was the January 13th and next coupon date is July 13th, the accrued interest on March 5th, would be:

$$\text{AI} = \frac{6.90}{2} * \frac{52}{180} = 0.996667$$

3. Actual/360 Day Counting: In this convention, the coupon days are calculated as actual number of days in between two dates but the year is considered as containing 360 days. This is widely used in Swap valuation.

4. *Actual/365 Day Counting*: In this convention, the coupon days are calculated as actual number of days in between two dates but the year is considered as 365 days. This day count convention is used in Indian money market.

Globally, different countries use different conventions for their fixed income markets. In addition, these may be different for money market and bond market in same geography (e.g. India).

5.2.1 Current Yield

Current yield is the simplest measure of the yield on a bond and oldest form of yield used in the market to compare various bonds in terms of their relative attractiveness of investment. It assumes only one period investment and it can rank all the bonds. Any bond in which the current yield is lower than the other short term interest rate, it would imply that the bond has holding (running) cost. This means that the investor would relatively be less compensated by investing in this bond vis-à-vis other short term instruments which are more attractive in terms of return.

It calculates the bond's coupon income as a proportion of the clean price paid for the bond. The formula used to calculate current yield is:

$$\text{Current Yield} = \frac{\text{Coupon}}{\text{Clean Price}} * 100$$

Example: Bond 7.17% GS 2028 (8-Jan-2030) is trading at 7.85% or at Rs 96.2290. The current yield of this bond is 7.45% [= (7.17/96.2290)*100)] vis-à-vis the coupon of 7.17%.

5.2.2 Yield to Maturity (YTM)

The simple yield is an improvement over the current yield measure as it takes into account capital gains or losses vis-à-vis face value of the bond. Let us experiment with the 9-year 6.90% annual coupon paying Bond currently trading at ₹96.7434. First, this is a bond selling at discount as the present interest rate is higher than the coupon of the bond. The implied yield of the bond is 7.4106% using Excel formula:

=YIELD (START_DATE, MATURITY_DATE, COUPON, CLEAN_PRICE, REDEMPTION, COUPON_FREQUENCY, DAYCOUNT)

For simplicity, we have taken a round year of 9 years, but the example can be explained with bonds trading between two coupon dates. The formula used for yield approximation is:

$$YIELD = \frac{(COUPON + (FV - CLEAN\ PR)/(MATURITY))}{(FV * 0.40 + CLEAN\ PR * 0.60)}$$

$$= \frac{(6.90 + \frac{(100 - 96.7434)}{9})}{(100 * 0.4 + 96.7434 * 0.6)}$$

$$YIELD = \frac{(6.90 + 0.3632)}{98.0385} = 7.4086\% = 7.41\%$$

The implied yield can be best approximated using the above formula. If the same bond would have been traded using semi-annual coupon payment, the clean price of the bond

would have been ₹96.7022. Now, we can use the above concept / formula by modifying the frequency as follows:

$$YIELD = 2 * \frac{((\frac{COUPON}{2}) + (FV - CLEAN\ PR)/(2 * MATURITY))}{(FV * 0.40 + CLEAN\ PR * 0.6)}$$

$$YIELD = 2 * \frac{(3.45 + 0.1832)}{98.0213} = 7.4131\%$$

Since we use Clean Price in the computation of the Yield in the above formula, we will not consider the accrued interest here. Hence, the concept will not change if we want to find out the yield of a security between two coupon payment dates. The above approximation of 40% weight for Face value and 60% for Clean Price is an age old practice adopted by bond traders and it gives a fair approximate yield for the bond.

From the yield of the bond, we can also find out the clean price using an approximation formula. We will use the following formula:

$$Price\ (CP) = \frac{C}{r\%} * \left(1 - \frac{1}{(1 + r\%)^N}\right) + \frac{100}{(1 + r\%)^N}$$

If we use our example above with Annual Coupon paying bond paying 6.90% coupon and trading at 7.4086%,

$$^{6.90}/_{7.4086\%} = 93.1350, \left(1 - \frac{1}{(1 + 7.4086\%)^9}\right) = 0.4744, \frac{100}{(1 + 7.4086\%)^9} = 52.5592$$

Price (Clean) = 93.1350*0.4744 + 52.5592 = 96.7432 which is very close to what we used above as the Price in the equation where we used 40% and 60% approximation.

If we use the Excel Formula with = PRICE (START_DATE, END_DATE or MATURITY_DATE, COUPON, YIELD, 100, 1, 4), we also get the price as 96.7432 which exactly matches with our calculation.

At times, a trader would like to know the Holding Period Yield from the Effective Annual realized yield. This is found out by using a simple equation: HPY = (1+EAY)^(n/365) - 1.
If my effective annual return (yield) is 8%, then the HPY for 30 days would be = (1.08)^(30/365) - 1 = 0.63% for 30 days.

We can also calculate simple Yield to maturity using a very simplified formula.

$$Simple\ Yield\ to\ maturity = \frac{C}{P} + \frac{100 - P}{n * P}$$

Here C = Coupon, P = Clean price, 100 = Face value, n = number of years to maturity. For our bond of 6.90% coupon trading at 96.74.32 with 9 years of maturity, the simple yield to

maturity would be 7.51% which is higher than the Yield to Maturity of 7.41%. This is higher because, the simple yield to maturity does not consider the principle of compounding. This is not commonly used in India but Japanese Government Bond market uses it very widely.

Yield to Maturity is a very simple measure and does not take into account the time value of money as it uses the same yield to discount all future cash flows irrespective of their time of arrival. The YTM is the discount rate that equates the discounted future cash flows and principal to be received with the present value or current price of the bond. In other words, it is the internal rate of return (IRR) or the expected rate of return on the bond. YTM can be calculated iteratively using standard spreadsheet YIELD function available in MS Excel. There are various calculators and software's available that provide YTM or yield as an inbuilt function.

As can be seen the YTM calculation for a semi-annual coupon bond is very complex. In order to simplify process of bond yield calculation, approximate yield to maturity formula can be used. A more precise estimation is done by averaging the traded price with the redemption price, which is par or ₹100.

$$\text{YTM} = \frac{\text{Interest Income} + \text{Price Change}}{(0.60 * \text{Traded Price}) + (0.40 * \text{Redemption Price})} * 100$$

For example, let's calculate the yield of 6.90% semi-annual coupon paying bond maturing in 9-years and currently trading at ₹96.7308.

$$\text{Interest Income} = \frac{6.90\%}{2} * 100 = 3.45$$

$$\text{Price Change} = \frac{(100 - 96.7308)}{18} = 0.181622$$

$$\text{YTM} = \frac{3.45 + 0.181622}{(0.60 * 96.7308) + (0.40 * 100)} * 100 = 3.7042\%$$

YTM of the above bond would be 3.7042%*2 = 7.4084% considering semi-annual coupon payment.

Above is a rough and approximate method of calculating bond yield. Present value methodology is a more accurate measure to calculate YTM, but it too, assumes that interest income is reinvested at the same rate. The actual return will be determined by a number of factors, including whether the investor is going to spend the interest income or reinvest it and at what rate.

Spread Sheet Method using MS Excel: The YTM of a coupon paying security, whose price is known can be found out using the following function in MS Excel:

= YIELD (settlement, maturity, rate, clean price, redemption, frequency, basis)

Wherein:

Settlement date is the date on which purchaser pays the seller
Maturity is the date on which the bond matures in future
Rate is the promised fixed coupon of the bond
Redemption would be the Par value or Face value which is set at 100
Frequency refers to the number of coupon payments in a year: for India, we use 2 (i.e., semi-annual)
Basis is the type of day count basis to use. (E.g. 4 in this Excel formula for G-Secs in India which uses 30/360 basis)

Yield on a zero-coupon bond: A zero-coupon bond has a single cash flow resulting from an investment. The zero-coupon pricing formula can be modified to calculate YTM.

$$\mathrm{P} = \frac{100}{\left(1 + \mathrm{r} * \frac{\text{Days to Maturity}}{365}\right)}$$

$$YTM = r = \frac{100 - P}{P} * \frac{365}{Days\ to\ maturity} * 100$$

The coupon rate (CR), current market yield (CY) and yield-to-maturity (YTM) are related such that:

Bond Selling at	Relationship				
Par	CR	=	CY	=	YTM
Discount	CR	<	CY	<	YTM
Premium	CR	>	CY	>	YTM

5.2.3 Effective Yield

Deposit taking institutions (like banks) often quote two interest rates when they advertise interest rate on various products they are selling. The first is the actual annualized interest rate known as nominal rate or stated rate. The second rate is an equivalent rate which produces same final amount at the end of 1 year if simple interest is applied. This is called the "effective yield". A nominal interest rate of r per annum, compounded m times per year, is equivalent to an effective annual yield of

$$Y = (1 + \frac{r}{m})^m - 1.$$

For example, a bond paying 4.20% annual coupon would be worth 4.28%, if coupon is paid every month. [= (1+0.042/12)^12 - 1 = 0.042818 = 4.28%].

Point to note that multiplying semiannual yield by 2 will give an underestimate of the effective annual yield. The proper way to annualize the semiannual yield is by applying the following formula:

$$Effective\ Annual\ Yield = (1 + periodic\ interest\ \ rate)^n - 1$$

For a semiannual- pay bond, the formula can be modified as follows:

$$Effective\ Annual\ Yield = (1 + semi\ \ annual\ interest\ \ rate)^2 - 1$$

Similarly, semiannual yield is:

$$SemiannualYield = 2 * ((1 + Annual\ \ Interest\ rate)^{\frac{1}{2}} - 1)$$

5.2.4 Yield to Call

Yield to call (YTC) is calculated by modifying the date of maturity. If a bond is having a call date, then the market would calculate the Yield to Call while the bond is trading. A 10-year bond with a call option on the anniversary of 5th year would trade as a 5-year paper. Bonds having Call option would be trading at a higher rate as investor would like to be compensated for the additional risk they take by investing in the bond (i.e., the risk of being called early). While calculating the price of the callable bond, Call price of the bond should be the final value instead of face value of 100.

YTC is basically the percentage rate of a bond if the investor buys and holds the security until the call date. Generally, YTC is calculated with the assumption that the bond would be called on next call date. Like the YTM, the YTC is found by solving for the rate which equates the present value of the cash flows (CFs) to the market price. That is:

$$P_0^b = \sum_{t=1}^{CD} \frac{CF_t}{(1+YTC)^t} + \frac{CP}{(1+YTC)^{CD}}$$

Where CP = Call Price and CD is the Call Date.

Here, a 10-year, 9% coupon bond with call date on 5 year at a call price of ₹105, paying interest semiannually, and trading at ₹93.769, would have a YTM of 10% and a YTC of 13%:

$$93.769 = \sum_{1}^{5} \frac{4.50}{(1+YTC)^t} + \frac{105}{(1+YTC)^{CD}} \Rightarrow YTC = 0.065$$

*Annualized YTC = 2 * (0.065) = 0.13*

The YTC can be approximated by calculating the average rate to call (ARTC) given as:

$$\text{ARTC} = \frac{\text{C} + (\text{CP} - \text{P}_0^{\text{b}}) / \text{CD}}{(\text{P}_0^{\text{b}} + \text{CP}) / 2}.$$

In this example, the bond's ARTC is 13.58%:

$$ARTC = \frac{4.50 + (105 - 93.769)/5}{(105 + 93.769)/2} = 0.0679$$

*Annualized ARTC = 2 * (0.0679) = 0.1358*

5.2.5 Yield to Put

Yield to Put is exact opposite of Yield to Call but the principle is the same. The Put option gives the investor the right to redeem the bond after a certain date and such papers trade in the market by adjusting their maturity till the first Put option date.

5.2.6 Yield to Worst

Many callable bonds have multiple call dates with Call premiums mentioned in the indenture of the bond. Investors calculate Yield to Call at all possible Call dates and the yield which comes out to be the lowest is referred to as Yield to Worst.

5.2.7 Yield for Portfolio

The yield for a portfolio of bonds is calculated by solving for the rate that equates the present value of the portfolio's cash flows to the market value of the portfolio. Point to note here is that the yield for a portfolio of bonds is not the average or the weighted average of the YTMs of the bonds making up the portfolio.

5.2.8 Yield for Money Market

Money market instruments are short-term instruments which mature within a year. Yield measures for money market instruments are annualized but not compounded as there is only a single cash flow till maturity in general. These instruments have different maturity periods and hence for the estimation of the yield, money market instruments need to be converted to a common basis. Such yield is also known as B*ond Equivalent Yield* (BEY). This can be understood better with the following example for estimation of a T-Bill's yield.

Treasury Bills (T-bills) are money market instruments to finance the short term requirements of the Government of India. These are discounted securities and thus are issued at a discount to face value and redeemed at par (₹100). The return to the investor is the difference between the maturity value and issue price. The Bond Equivalent Yield (BEY) of Treasury bill is calculated using this formula:

$$\text{BEY} = \frac{\text{Face Value} - \text{Price}}{\text{Price}} * \frac{365}{\text{Days to maturity}} * 100$$

This uses Actual/365 day count convention as prevalent in Indian Money Market.

5.2.9 Yield for floating rate bonds

Floating rate bonds (FRBs), sometimes referred to as floaters, differ from standard bonds in that the interest rate, or coupon, paid out to the investor fluctuates. FRBs are securities with no fixed coupon rate. The coupon rate is variable and gets reset at pre-announced intervals (say, every six months or every one year).

For example, an FRB was issued by the Government of India on November 7, 2016 for a tenor of 8 years, thus maturing on November 7, 2024. The variable coupon rate is arrived at

by taking the average rate of the implicit yields at the cut-off prices of the last three auctions of 182-day T-Bills, held before the date of notification. These are rounded off up to two decimal places. Similarly, for the subsequent semi-annual periods, the average (rounded off to two decimal places) of implicit yields at the cut-off prices of the last three auctions of 182-day T-Bills held up to the commencement of the respective semi-annual coupon periods was considered. The interest payment is based on this variable coupon rate. FRBs trade very close to 100 or the Face value as they get reset every coupon fixation date.

Sample Questions:

1. The most important assumption of YTM is _____.
   (a) Reinvestment of the future coupons at different rate
   (b) Reinvestment of the future coupons at the same yield to maturity
   (c) YTM is a flat curve after 15 years of maturity
   (d) YTM is only relevant for G-Secs

   Ans: (b)

2. The Spot Yield is explained as _____.
   (a) A flat yield charged over the life of the Bond
   (b) The yield relevant for a particular maturity
   (c) It is always derived from YTM
   (d) The yield which is converted into Dollar terms using spot exchange rate

   Ans: (b)

3. A Bond of face value Rs 100 with 10-year residual maturity, paying 8.2% semi-annual coupon, is currently trading at a yield of 7.80%. What would be its approximate Price?
   (a) Rs 101.2684
   (b) Rs 100.3423
   (c) Rs 103.5684
   (d) Rs 102.7423

   Ans: (d)

4. In which situation the Callable Bonds are likely to be "Called"?
   (a) When interest rate is high
   (b) When interest rate is lower than the coupon rate
   (c) When the callable bond trades at Par
   (d) When the callable bond trades below Par

   Ans: (b)

5. A Bond would receive Rs 6 every six-months for the next 2 years and Rs 100 (face value) at the end of these 2 years as the redemption value. What would be its price, if the market yield has increased by 100 bps after its coupon was decided (when it was issued at Par)?
   (a) Rs 101.25
   (b) Rs 98.29
   (c) Rs 98.95
   (d) Rs 99.45

   Ans: (b)

CHAPTER 6: TERM STRUCTURE OF INTEREST RATES

LEARNING OBJECTIVES:

After studying this chapter, you should know about:

- Yield curve and Yield curve theories
- Relationship between Spot and Forward Rates
- Determinants of the Shape of the Term Structure

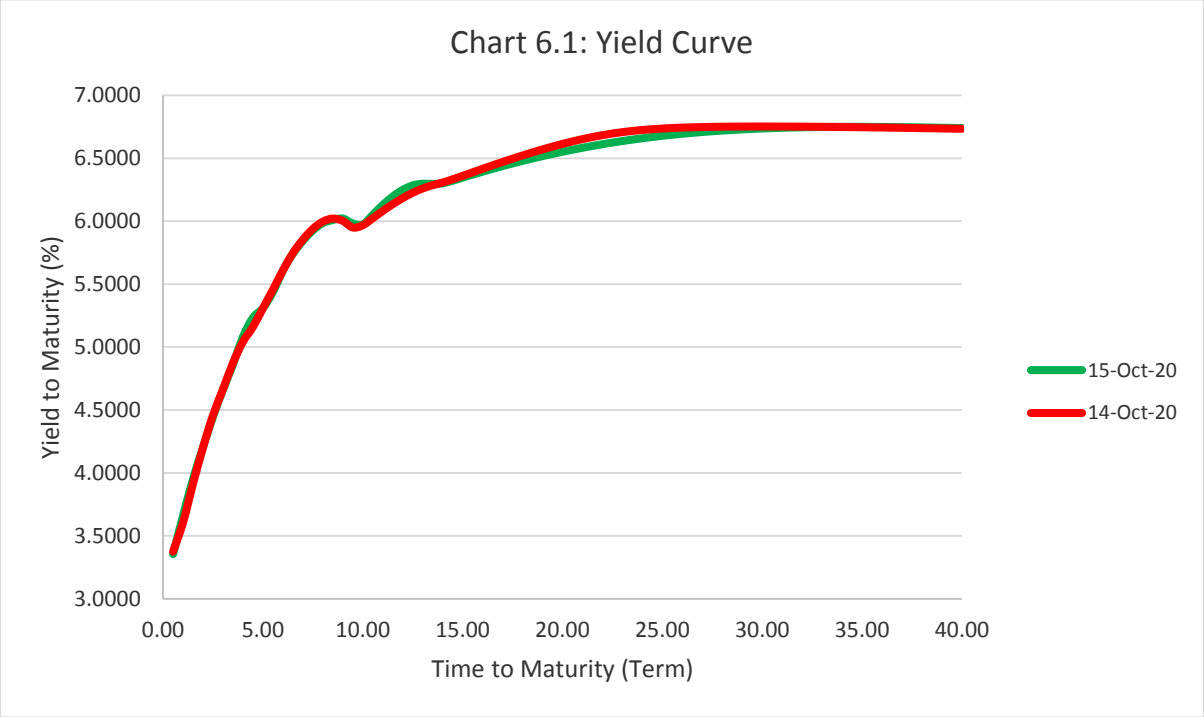
6.1 Yield Curve and Term Structure

In order to explain the term structure, pure economic theory suggests that the main factor explaining the differences in the interest rates paid on different securities may be because of the differences in their terms of maturity assuming all other quality and characteristics of the bond are the same. Thus, the relationship between the terms of securities and their market interest rates is commonly known as the term structure of interest rates. The diagram that is called as the yield curve and as described in this chapter is used to display the term structure of interest rates on securities of a particular type at a particular point in time.

In this unit, we will focus solely on term structure of interest rates. The term structure of interest rates talks about the variation of the yield or interest rate offered on bonds with similar risk profiles, with the change in maturity terms of those bonds. The term structure of interest rate typically talks of spot yields for various maturities (interest rate on a particular day offered for bonds of different maturities but with similar risk, assuming no reinvestment involved, and all bonds are assigned as bullet payments). However, the yield curve is the relationship of the yield to maturity (YTM) of bonds on a particular day using the similar convention with similar risk to the time to maturity of the bonds. Generally, bonds with longer maturities offer higher yields to compensate for the inconvenience to the investor in parting her money for longer periods against the promise of return of periodic payments and the principal till the time of maturity. The term structure of interest rates has 3 characteristics: (a) The change in yields of different term bonds with similar risk tends to move in the same direction, (b) The yields on short-term bonds are likely to be more volatile than long-term bonds, and (c) The yields on long-term bonds tend to be higher than short-term bonds because of higher risk and opportunity loss as well as demand and supply factors.

The yield curve and term structure of interest rate are two different concepts. The Yield curve solely relies on YTM while term structure builds on Spot interest rate. The Yield curve depicts the relationship between the time to maturity and yield (implied rate of return) being paid on similar quality bonds for different maturities. From the yield curve, expected

yield for a given maturity can be identified and used for bond related value computations. Needless to say that the yield curve for Sovereign bonds would be different vis-à-vis AAA corporate bonds. Yield curve has to be estimated for each rating class separately for valuing the bonds pertaining to the said rating class in different maturities. The daily intra-day yield curve for Government of India securities can be found on the CCIL website. Financial Benchmarks India Limited (FBIL) also publishes the yield curve on daily basis for the Indian fixed income markets.

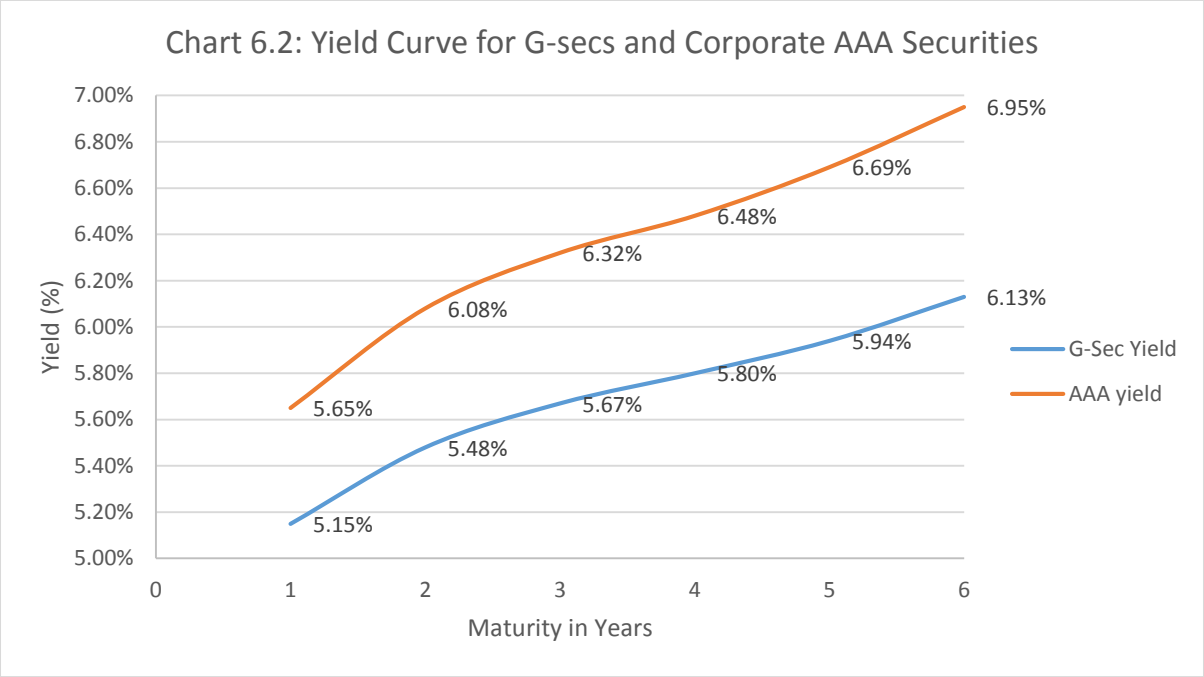


As the maturity increases, investors want higher yield from their debt investments. However, in most countries, yield curve flattens for Government securities after it reaches a particular term to maturity. The reason for flattening is the absence of the Credit or Default risk on Sovereign Bonds.

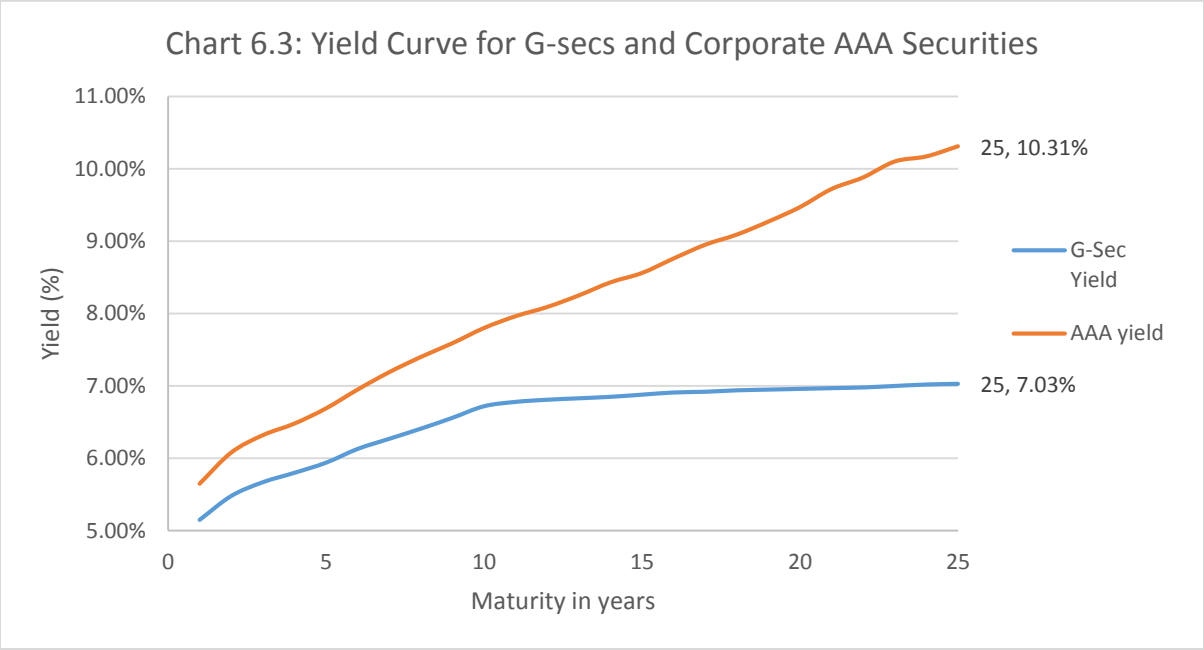
6.1.1 Yield Curve

Yield curve is typically an upward sloping curve in a two dimensional graph depicting the relationship between time and yield expected from a debt security of a given maturity. The slope of the curve gives us the relative risk premia for additional time we are out of money as being lent. In the yield curve presented below in Chart 6.2 taking higher risk of investing for 2 years as against 1 year results in a term risk premia of 19 bps. But, if we invest for 3 years as against 2 year, we get a term risk premia of only 13 bps and the more or less same term risk premia is maintained for our investment for 4 years as against 3 years**.** The term risk premia depicts the perception of risk of investment for a higher maturity that is depicted in the slope of the yield curve. Typically, in sovereign bond market, we see the yield curve flattens after some years as the risk of default is zero and investor only want a

small premia to cover the liquidity risk of the investment. However, for corporate bonds, the term risk premia significantly increases as the time to maturity increases, making the slope having a good upward movement.



If we look at longer maturities, the contrast of risk premia for corporate Bonds can be easily observed. Higher maturities demand much higher risk premia vis-à-vis Government bonds.

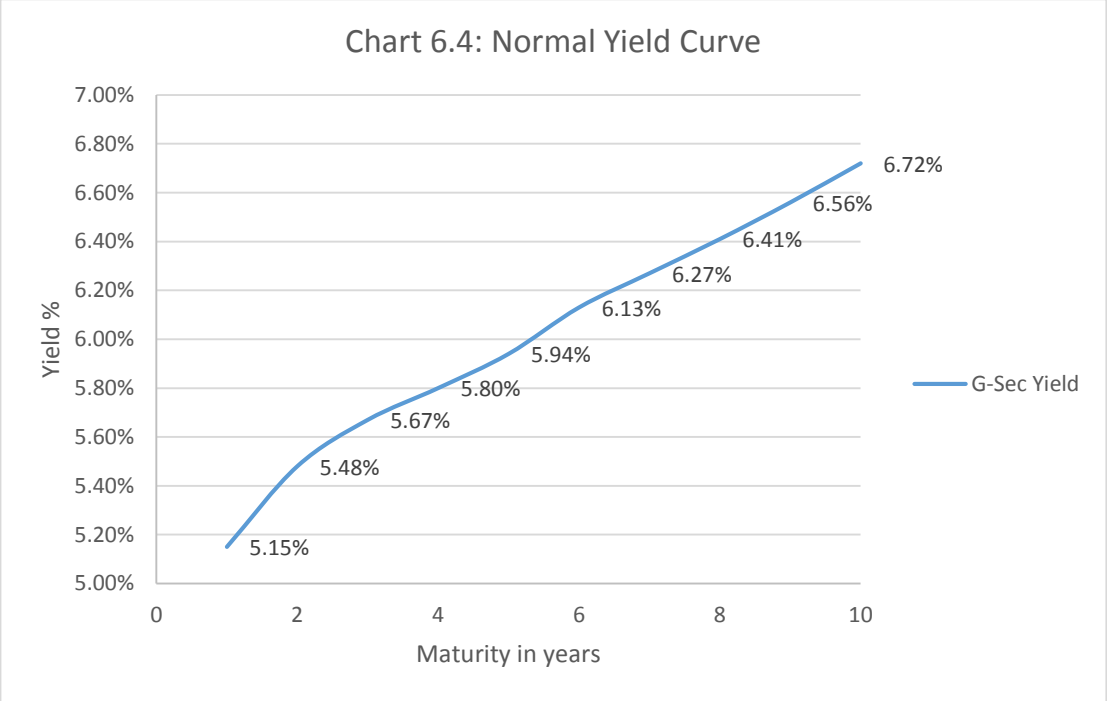


Investors have different expectation about the future and do demand different rates for various maturity investments even if the rating remains the same. This makes yield curve overall jagged. If investors are expecting higher inflation in future, they would require

higher nominal yield to compensate them for the expected higher expenditure for deferring their present consumption to a future date. A positively sloped yield curve is a most preferred yield curve for the economy as shorter term would demand lower yield while long term would demand higher yield.

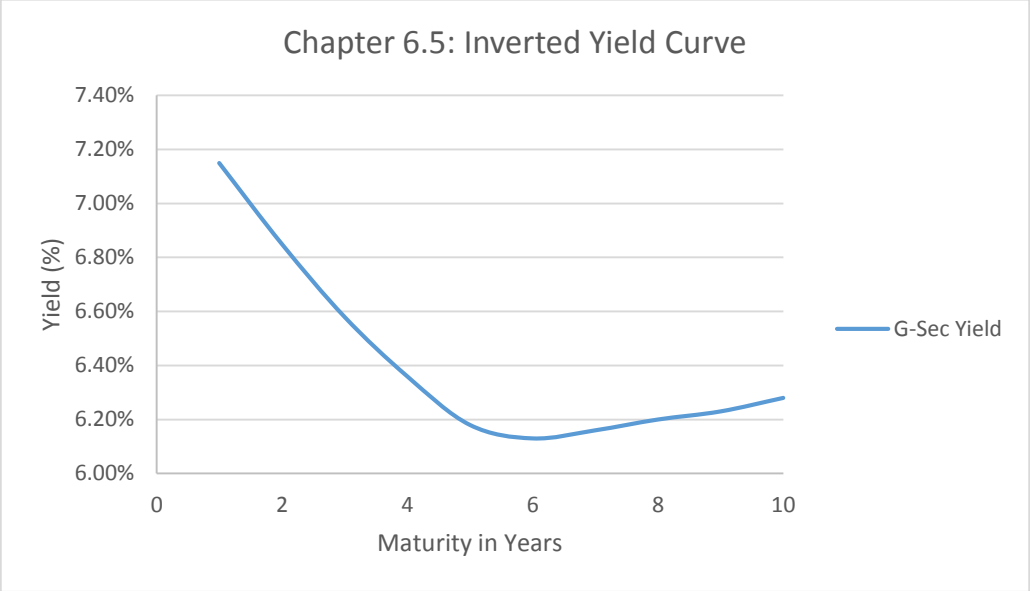
Typically, the yield curves take 4 shapes:

1. Normal Yield curve: This is an upward sloping yield curve indicating higher yield for higher maturity. Long term yields are higher compared to short term yields as the risk premia is higher for higher maturities. It is thought to reflect the higher inflation-risk premium that investors demand for longer term bonds. The positive slope of the yield curve here reflects investors' expectations for the economy to grow in the future and, importantly, for this growth would be likely to be associated with a greater risk of inflation in the future.

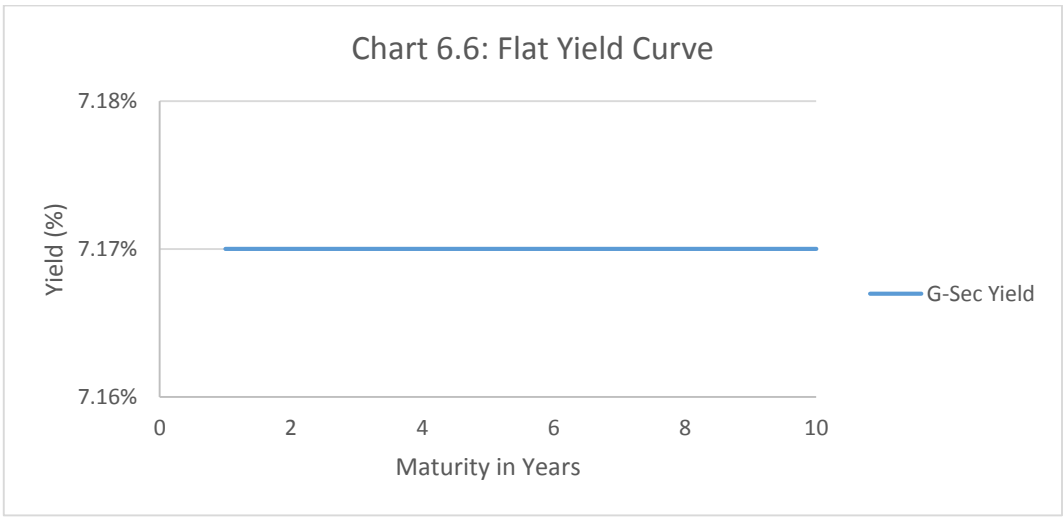


2. Inverted Yield curve: In this kind of curve, the short term yields are higher than the long term yields. At times, the policy rates are kept high to bring down excess demand and reduce financial bubbles created due to easy availability of credit and use of high leverage by the borrowers. At times, severe asset liability mismatch may also produce inverted yield curve. Typically, borrowers tend to create long term assets out of short term liabilities assuming the possibility of rolling over their borrowing and easy access to credit because of smoother availability of funds. An inversion happens, if assets are not sufficiently maturing to pay back the maturing liabilities and the borrower is not able to get easy credit, the short term demand for funds can be very high resulting in very high interest rate at the short end and lower interest at medium term. This shape is often seen when the market expects interest

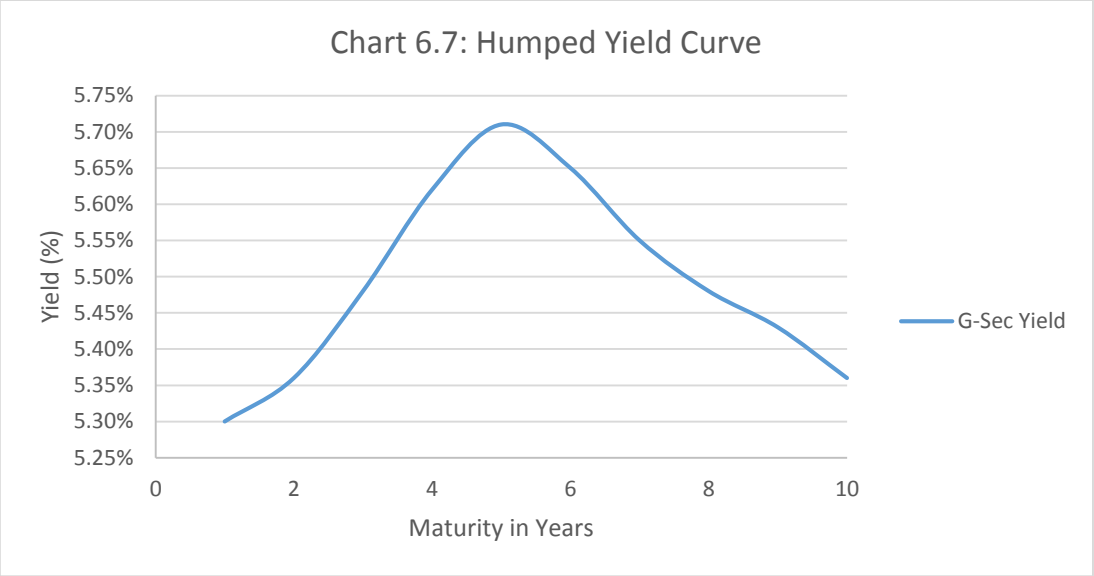
rates to fall. Under this abnormal and contradictory situation, long term investors may settle for lower yields now if they think the economy is likely to slow or even decline in the future. An inverted yield curve may indicate a worsening economic situation or recessionary situation in the future. However, technical factors such as a flight-to-quality or global economic or currency situations may cause demand for bonds on the long end of the yield curve causing rates to fall.



3. Flat Yield Curve: Here yields remain constant irrespective of time to maturity. There is no difference between short term yield and long term yield indicating no extra premium for higher maturities. A small or negligible difference between short and long term interest rates occurs later in the economic cycle when interest rates increase due to higher inflation expectations and tighter monetary policy. This is called a shallow or flat yield curve and higher short term rates reflect less available money.



4. Humped yield curve: At times, yield curves can be humped and the short term and long term yields would be lower than medium term yield.



These shapes of the yield curve help us to study various theories pertaining to yield curve:

(i) Pure Expectation theory;
(ii) Liquidity Preference theory;
(iii) Market Segmentation theory;
(iv) Preferred Habitat theory.

Yield curve theories explain as to why: (a) Yields for different maturities move together – yield changes are unidirectional (an investor would not expect that 10 years yield will rise while 5-year yield would fall); (b) The lower short term rates result in steep upward sloping yield curve while higher short term rates would see a downward sloping yield curve; (c) We normally see upward sloping Yield curves that explains higher premium is paid for longer out of the money concept.

(i) Pure Expectation theory

The pure expectation theory is based on the assumption that bonds of different maturities are perfect substitutes with one another. The long-term yields are derived as simple geometric mean of the short-term yields for the same time period. The important assumptions in this theory are: (1) no transaction cost for investing and holding bonds – people can directly buy and hold without any kind of agency cost or infrastructure cost; (2) investors do not have any special preference for bonds of a particular maturity (it goes against the preference for benchmark bonds prevalent globally among bond traders) and they can switch bonds without paying any additional cost for such kind of switching activity; and (3) investors will form similar kind of expectations with regard to the future interest rate. The investors aim to maximize their holding period returns. We will use the following example to explain the basic design of this theory.

Let us consider investment strategies for two-period horizon:

1. Option 1: Our investor buys one-year bond and when the same matures in one year's time, the investor uses the proceeds to buy another one-year bond.
2. Option 2: Our investor is totally risk averse and wants to buy a two-year bond and hold it until maturity.

Suppose r_{t1} is the interest rate per annum for 1 year investment and r_{t2} is the interest rate for annum for 2 year investment. And, interest rate to be obtained by investor after one year maturity (a forward quote) is: r^e_{t1+1}.

The first option would result in a cash flow equivalent to (1+r_{t1}) * (1+r^e_{t1+1}) – 1. The money received after one year is reinvested for a further period of one year after this first one year's maturity. The product would be $1+r_{t1} + r^e_{t+1} + r_{t1} * r^e_{t1+1} - 1$. Since the term ($r_{t1} * r^e_{t1+1}$) would be very small and negligible, the final equation would be $r_{t1} + r^e_{t1+1}$.
The investment value for a straight forward 2 year investment with assumption of reinvestment and compounding would be (1+r_{t2}) $*$ $(1 + r_{t2})$-1 = 2*r_{t2} + (r_{t2})^2. Again, $(r_{t2})^2$ would be very small and negligible, therefore we have only 2*r_{t2}.

As both options are expected to be equivalent in order to eliminate any kind of arbitrage opportunity from the investment options, this implies: 2*r_{t2} = $r_{t1} + r^e_{t1+1}$
Or, $\frac{r_{t1}+r^e_{t1+1}}{2} = r_{t2}$

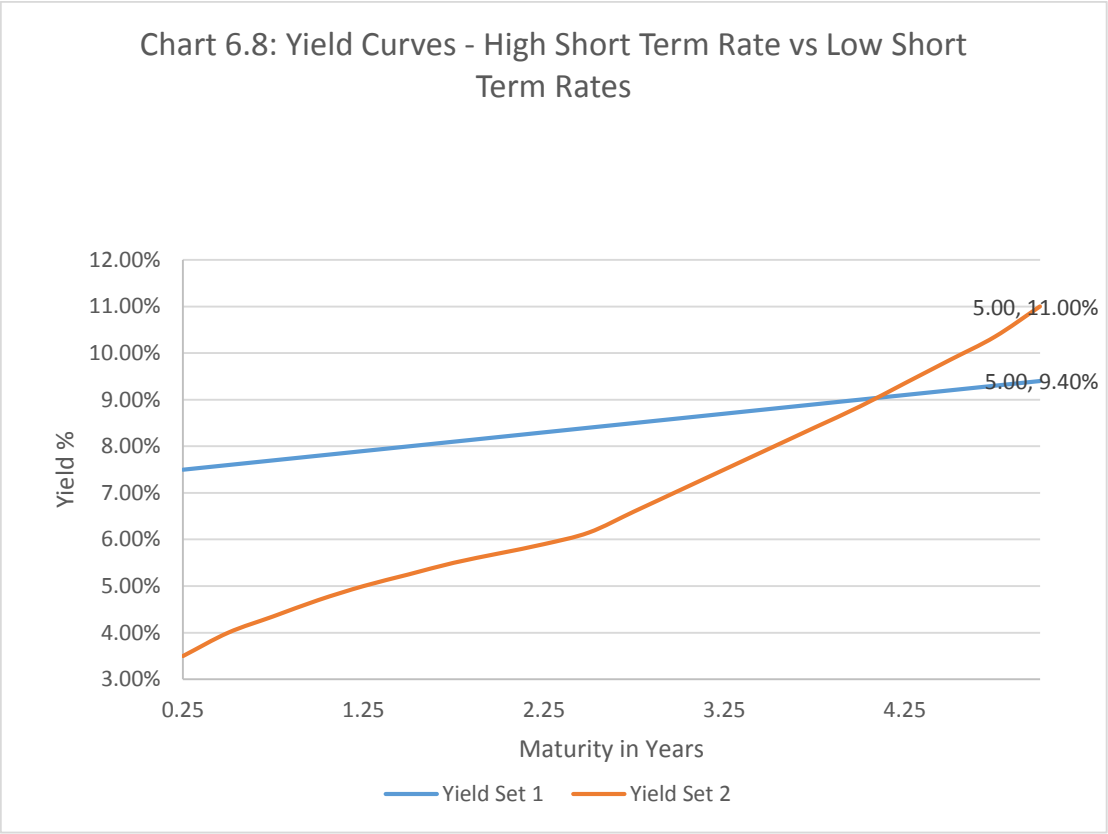
We can rewrite more generally and theoretically (even though interest rates are non-additive properties) for n-period as:

$$i_{nt} = \frac{i_t + i_{t+1} + i_{t+2} + \ \ldots \ + i_{t+(n-1)}}{n}$$

The above equation is generalized to simply imply that the interest rate on a long-term bond equals the average of short rates expected to occur over life of the long-term bond. The above theory helps us to understand: (a) when short term interest rates are expected to increase in future, average of future short term rates = i_{nt} which will be above today's short term rate and hence the yield curve is upward sloping; (b) the yield curve is flat only when short term rates are expected to stay the same in future, average of future short term rates is same as today's; (c) when short term rates are high and hence expected to fall in near future, yield curve is likely to be downward sloping.

The yield curves are likely to have upward slope when short term interest rates are low and downward sloping when short term rates are high because: (a) when short term rates are low, the same is expected to increase to normal level; (b) The yield curve is likely to have steep upward slope as long term rate is equal to more or less the average of future short term rates; (c) when the short term rates are high, the same is expected to fall in future to

their normal level; (d) The yield curve will have a downward slope, if the long term rate is below the current short term rate.



(ii) Liquidity preference (or liquidity premium) theory

The liquidity preference theory is not very much different from the pure expectation theory but it has one clear and distinct difference. This theory says that the interest rates for the long-term assets should be higher than the interest rate offered on short-term assets for the following reasons: (a) Bonds of different maturities may be substitutes but these are not perfect substitutes; (b) Investors may prefer to hold short-term rather than long-term bonds. This means that investors must be paid positive liquidity premium, l_{nt}, to invest in long term bonds. This means:

$$i_{nt} = \frac{i_t + i^e_{t+1} + i^e_{t+2} + \ \ldots \ + i^e_{t+(n-1)}}{n} + l_{nt}$$

Liquidity premium increases with the maturity of the bond. This implies that long term bonds are likely to be less liquid and hence the liquidity premium would be high as maturity increases. This is very much prevalent in corporate bonds than in Government bonds.

(iii) Market segmentation theory

Investors prefer to invest for short term. Hence, the depth in the market would be determined by the demand and supply of assets in the market. Further, investors have preference for lending terms and would not be comfortable to lend beyond their own

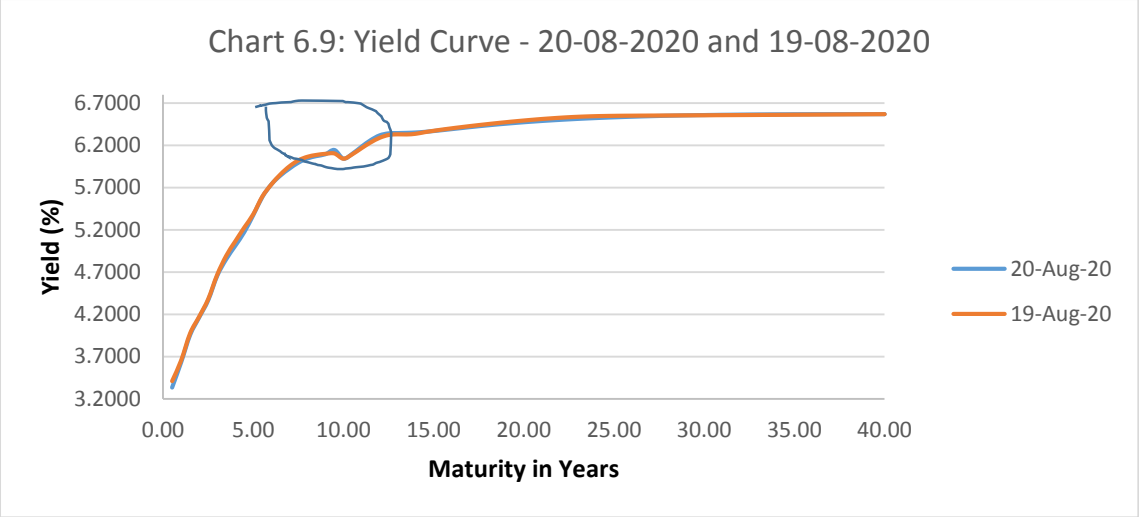
preferred lending horizons and similarly, the borrowers have specific requirements for funds with regard to the horizon of borrowing. This theory assumes that bonds of different maturities are not exact substitutes at all and hence markets are completely segmented and we need to determine the interest rate for each maturity separately. The demand for a particular segment has its demand and supply structure.

For example, 10-year benchmark Government security in India would have a different interest rate structure compared to less liquid 9-year bond or 11-year bond. This goes against the pure expectation theory that the investors are indifferent to bonds of different maturity as they treat all bonds as substitutes for one another.

The market segmentation theory may not be able to explain as to why the yields on bonds of different maturities tend to move in unidirectional manner. The yield or price for each bond is different and is to be determined by the relative supply and demand for that bond only, even if their maturities are same or close. For example, two bonds maturing in 2034 may have different yields as demand for the bonds would be different. A substantially higher demand for 6.19% GS 2034 security resulted in lower yield of 14 bps as given in the Table below. The maturity date is more or less close, but demand for the first bond is very high. This may be because of "On the run" issues. The concept of "On the Run" is very common in the Government Bond market. The securities which are in demand is typically termed as "On the Run" securities because these are recently being issued by the Government through Auction and market participants are gearing up to warehouse such stock purely these are more liquid stocks. These stocks are also generally short-sold in the market by trades to speculate on the possible movement of the yield of these securities. The securities that are typically recently issued and may be trading as "On the Run" securities when most market participants would like to have the security in their portfolio but the auction quantity is not able to satisfy such excessive demand.

Settlement Date	Description	Maturity Date	Trades	Total Volume (Mil)	Weighted Average Yield
26-Oct-20	6.19% GS 2034	16-Sep-34	987	1,06,975.14	6.2303
26-Oct-20	7.5% GS 2034	10-Aug-34	5	2,250.00	6.3707

As per the market segmentation theory, a normal yield curve would be the result of a relative higher demand (supply) for short maturity bonds vis-à-vis a long maturity bond.



The yield curve in Chart 6.9 is plotted with the traded bonds for both 19-Aug-2020 and 20-Aug-2020. The yield curve shows a dip at about 10 years because of excessive demand for the 10-year benchmark which is being traded as "On the Run" security and market participants are willing to pay a premium price (extra few paise compared to other nearby bonds traded in the market) to acquire this bond.

Higher demand would result in lower interest rate (high demand means high price of bonds which implies lower interest rate). Similarly, when the demand for long maturity bonds is higher vis-à-vis the short maturity bonds, we will see mostly an inverted yield curve. This may arise because of high demand from Insurance companies who typically invest in long term bonds because of their Asset Liability structure and promise of payment over a long period of time.

(iv) Preferred habitat theory

A combination of the views in expectation theory and the liquidity preference theory are reflected in the preferred habitat theory. The prior is that bonds of different maturity can be substituted however the investors may have preference for selected maturity. This way the investors' expectation on short term rates would drive the long term interest rates after adjusting for the habitat premium.

The preferred habitat theory assumes that investors give importance to both the expected returns and the maturity of the investments. Investors would always prefer to invest in the short-term assets vis-à-vis the long-term assets and would not like to buy a long-maturity asset if the long-term maturity asset offers the same expected returns as a series of short-term assets. They would prefer to roll over the investment for a series of short terms. Hence, the long-term bond holders would require a term premium for their long-maturity investment.

Hence, if we consider the preferred habitat theory, we will find that the yield curve will be a natural upward sloping curve because of the term premiums for longer maturities. Further, as the long-term yields are partly an average of short-term yields, the yield curve is likely to tend to shift rather than twist. Hence, if the yield curve slopes: (a) slightly upward, yields are expected to stay about the same; (b) sharply upward, yields of short term maturities are expected to go up; (c) flat, yields of short term maturities are expected to drop slightly; (d) downward, yields are expected to drop sharply. Summarizing the theory, we can state that:

a) If the yield curve slopes slightly upward, investors predict interest rates to stay about the same.
b) If the yield curve slopes sharply upward, short-term rates are predicted to rise.
c) If the yield curve slopes flat, short-term rates are predicted to fall slightly.
d) If the yield curve slopes downward, the investors predict a sharp decline in interest rates.

The Preferred Habitat theory says that forward rates would be nothing but the expected future zero coupon (spot) rates and a premium, but the theory will not support the view that this premium is directly related to maturity. The supply or demand imbalance for funds in a given maturity range will induce lenders and borrowers to shift from their preferred habitats (maturity ranges) to one that has the opposite imbalance given a compensating incentive.

Example: If we assume that the current 1-year interest rate would drop from 10% to 9% to 8% to 7% to 6%. Also consider, the habitat premium for 1-year to 5-year bonds are 0%, 0.2%, 0.4%, 0.6% and 0.8%. What are the current interest rates for 2-year, 3-year, 4-year and 5-year bonds (using the arithmetic mean relationship)?

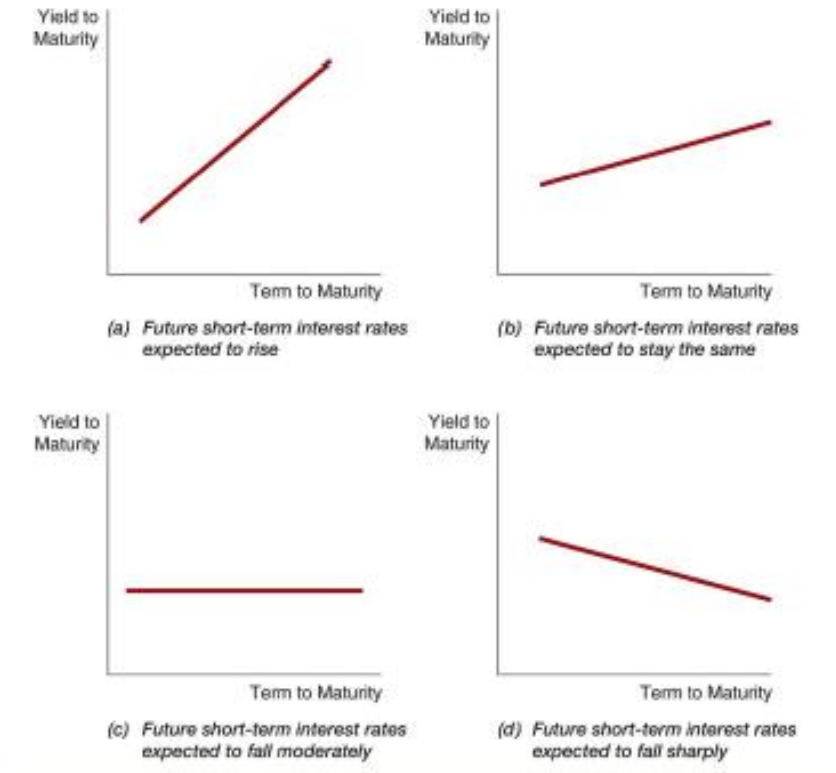
2-year bond: $r_{2t} = \frac{0.10+0.09}{2} + 0.2\% = 9.70\%$

3-year bond: $r_{3t} = \frac{0.10+0.09+.008}{3} + 0.4\% = 9.40\%$

4-year bond: $r_{4t} = \frac{0.10+0.09+0.08+0.07}{4} + 0.6\% = 9.10\%$

5-year bond: $r_{5t} = \frac{0.10+0.09+0.08+0.07+0.06}{5} + 0.8\% = 8.8\%$

From the above example, it is seen that despite the investors requesting an increasingly positive habitat premium for longer-term bonds, it is possible to have a downward sloping yield curve if the investors expect a sharp decrease in expected future short-term interest rates.



6.1.2 Spot Curve or Zero Coupon Yield Curve

The main weakness of the yield to maturity yield curve stems from the assumption of a constant rate for coupons reinvested during the bond's life. This ignores time value of money aspect. However, to take care of time value of money, we need to use the spot rates or zero coupon yield curve. For zero-coupon bonds like Treasury Bills, we can easily derive the spot rates or Zero rates from the observed prices. However, for the coupon bearing bonds, we use the Bond price equation in a modified form to extract the Zero rates or spot rates. We can use the following modification

$$Value = \frac{C}{(1+r1)^1} + \frac{C}{(1+r2)^2} + \frac{C}{(1+r3)^3} + \cdots \ldots + \frac{FV}{(1+rn)^n}$$

Since we receive half year coupons, we can rewrite the above equation as:

$$Value = \frac{C/2}{(1+r1/2)^{2*o.5}} + \frac{C/2}{(1+r2/2)^{2*1}} + \frac{C/2}{(1+r3/2)^{2*1.5}} + \cdots \ldots + \frac{FV}{(1+rn/2)^{2*tn}}$$

If we take out C/2 as common factor from the right side equation excluding the last term, then we will get the following equation:

$$Value = \frac{C}{2}\{\frac{1}{\left(1+\frac{r1}{2}\right)^{2*o.5}} + \frac{1}{\left(1+\frac{r2}{2}\right)^{2*1}} + \frac{1}{\left(1+\frac{r3}{2}\right)^{2*1.5}} + \cdots \ldots \frac{1}{\left(1+\frac{rn}{2}\right)^{2*tn}}\} + \frac{FV}{(1+rn/2)^{2*tn}}$$

For a new security that is being sold at Par or 100, the equation may be interpreted as following:

$$100 = {}^{C}/_{2} * Cum\ Dis\ Factor\ (CDF) + (100) *\ DF\ (Last)$$

Here:

C= Coupon amount

CDF = Cumulative Discount Factor (Sum of all Discount Factors)

DF = Discount Factor for the last maturity period

The r_1, r_2, r_3, …, r_n are the related spot rates pertaining to various maturities. The graph gives the details of the movement of Spot yield vs YTM. We have used the following Table to calculate the Spot Rates used for plotting the Graph. This is achieved using a Bootstrapping concept using the Par Curve.

Time	YTM	SPOT	DF	CDF	CPN	Last CF	CALC1	YLD
0.5	5.60%	5.60%	0.973	0.973	2.8	102.8	0	0
1.0	5.85%	5.85%	0.944	1.917	2.925	102.925	97.155	5.85%
1.5	6.20%	6.21%	0.912	2.829	3.1	103.1	94.058	6.21%
2.0	6.60%	6.63%	0.878	3.707	3.3	103.3	90.664	6.63%
2.5	7.15%	7.22%	0.838	4.544	3.575	103.575	86.749	7.22%
3.0	7.65%	7.76%	0.796	5.340	3.825	103.825	82.618	7.76%
3.5	8.40%	8.61%	0.744	6.084	4.2	104.2	77.572	8.61%
4.0	9.25%	9.62%	0.687	6.771	4.625	104.625	71.860	9.62%
4.5	10.20%	10.80%	0.623	7.394	5.1	105.1	65.467	10.80%
5.0	11.40%	12.42%	0.547	7.941	5.7	105.7	57.853	12.42%

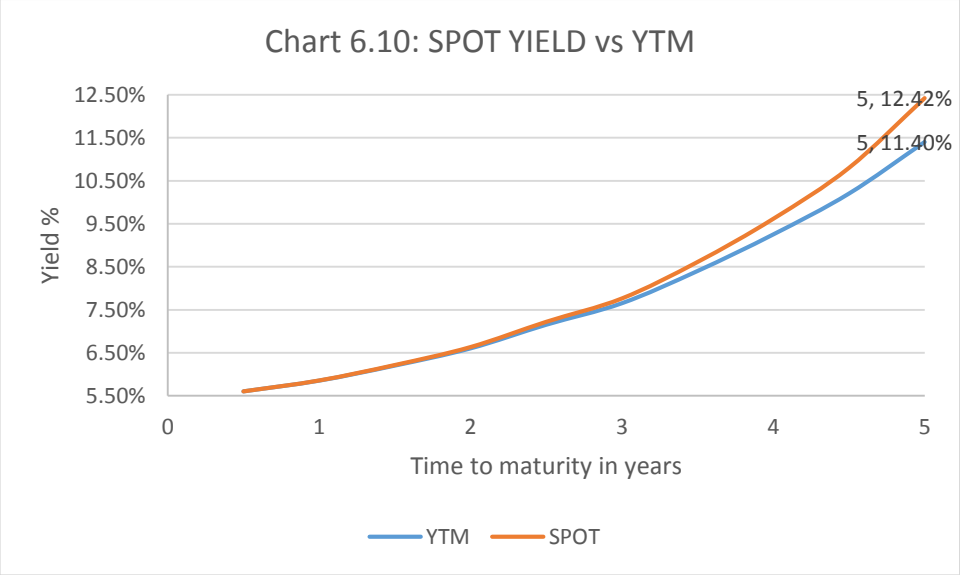
To start with, TYM and Spot Rate for 0.5 year is same, as there are no reinvestment options here. But, when we come to 1 year and if the bonds can be issued with a Par value of 100, the coupon would be 5.85% (equivalent to Yield for Price to be at Par value of 100). So, the equation would be as follows:

$$100 = \frac{(\frac{5.85}{2})}{(1+\frac{5.60\%}{2})^{2*0.5}} + \frac{(\frac{5.85}{2})}{(1+\frac{r2\%}{2})^{2*1}} + \frac{100}{(1+\frac{r2\%}{2})^{2*1}}$$

$$(1+\frac{r2\%}{2})^{2*1} = 102.925 \,/\, (100 - 2.8453)$$

Solving the above equation will give: r2 = 5.85% (spot Rate for Year 1).

The Spot curve diverges from the YTM curve as we increase the time to maturity.



6.1.2.1 Estimation of Zero Coupon Yield Curve

Bootstrapping method and Parametric method are two methods used for estimating Zero coupon yield curve or Spot curve using the observed yields from the trades executed in the market. The bootstrapping method of constructing the zero-coupon or spot yield curve considers each bond as a combination of multiple cash flows paying out coupons at various fixed time intervals (like one payment in 6-months). We put bonds of many maturities in ascending order of their maturities and then we link each bond with the other bond through the discount factor.

As an example, market has a 1-year bond with a coupon of 6.5% and two cash flows – one is coming in 6 months and the other is coming after 12 months. 6-month spot rate is 5.60% and for calculating the 1-year spot rate, we have to use 6-month rate for discounting the first cash flow to find out its present value. The rate implied for the second cash flow after equating the same to the final price would give us the spot rate for the 1-year maturity. If the bond is trading at 100.7189 with a YTM of 5.75%. The 6-month rate being 5.6% at present will make the first cash flow of 3.25 discounted by 5.6% rate to generate a present value of 3.1615. Hence, the spot rate for 1-year would be:

$$100.7189 = 3.1615 + \frac{(100+3.25)}{\left(1+\frac{r_{1yr}}{2}\right)^2}$$

$$r_{1yr} = 2 * \left(\sqrt{\frac{(100+3.25)}{(100.7189-3.1615)}} - 1 \right) = 5.7524\%$$

In similar ways, we find out the implied spot yields of future years using the spot rates of previous years.

The above example gives an idea as to how one can calculate the spot rate using trade price of an annual coupon paying bond paying the coupon semi-annually. The relation between the normal redemption yield to maturity and calculated zero-coupon or spot rates is thus:

Maturity	Redemption Yield to Maturity	Spot Rate
1 Year	5.000%	5.000%
2 Years	6.000%	6.025%
3 Years	7.000%	7.071%

In practice, the calculation of zero-coupon yield curve is much more complicated than the simple example above.

Another way of extracting Spot curve from the YTM curve is using a concept of Par Yield curve. Par Yield curve is the Curve consisting of securities being traded at their Par Value (100). Very few bonds would be trading at Par, a theoretical process of bootstrapping is used to derive the Spot Curve from the theoretical Par curve. For doing this, let us use a simple YTM curve prevailing on a day and extract the Spot and Forward Rate curve from there.

Maturity in years	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
Period	1	2	3	4	5	6	7	8	9	10
YTM	4.50%	4.65%	4.82%	4.99%	5.26%	5.40%	5.61%	5.83%	6.01%	6.17%

Assuming that the above Yield Curve (YC) is for G-Secs and government intends to issue bonds for the same tenure and coupon as specified in the YC (Hence all the bonds will be at par for the given YC). So, we can extract the Spot rate from the above by boot strapping the above YTM curve. First, we will do the calculation for 1-year as 6-month spot rate and 6-month YTM is same.

$$100 = \frac{(\frac{4.65}{2})}{(1+\frac{4.50\%}{2})} + \frac{(100+\frac{4.65}{2})}{(1+\frac{SPOT\ Y_1}{2})^2}$$

This will result into a Spot rate for period 2 (Year 1) as 4.652%.

Similarly, we can boot strap for Year 1.5 or Period 3.

$$100 = \frac{(\frac{4.82}{2})}{(1+\frac{4.50\%}{2})^{(2*0.5)}} + \frac{(\frac{4.82}{2})}{(1+\frac{4.652\%}{2})^{(2*1)}} + \frac{(100+\frac{4.82}{2})}{(1+\frac{SPOT\ Y_{1.5}}{2})^{(2*1.5)}}$$

This will result into a Spot Rate for 1.5 years as 4.83%.

Likewise, we will get a Spot Rate Curve for 5 years as follows:

Maturity	YTM	SPOT RATE
0.5	4.50%	4.50%
1.0	4.65%	4.652%
1.5	4.82%	4.83%

2.0	4.99%	5.00%
2.5	5.26%	5.28%
3.0	5.40%	5.43%
3.5	5.61%	5.66%
4.0	5.83%	5.90%
4.5	6.01%	6.09%
5.0	6.17%	6.27%

We can calculate the Forward rates from the above Spot rates using the following formula:

$$Forward\ (0.5, 1) = \frac{(1 + \frac{SPOT2}{2})^{(2*1)}}{(1 + \frac{SPOT1}{2})^{(2*0.5)}} - 1$$

Here, SPOT2 means Spot rate or zero coupon yield pertaining to 2nd time period. SPOT1 means the Spot rate for period 1.

The Forward Rate Curve would look like the following:

Maturity	YTM	SPOT RATE	FORWARD RATE
0.5	4.50%	4.50%	4.50%
1.0	4.65%	4.65%	4.80%
1.5	4.82%	4.83%	5.17%
2.0	4.99%	5.00%	5.53%
2.5	5.26%	5.28%	6.42%
3.0	5.40%	5.43%	6.16%
3.5	5.61%	5.66%	7.01%
4.0	5.83%	5.90%	7.58%
4.5	6.01%	6.09%	7.69%
5.0	6.17%	6.27%	7.89%

Forward rates will be discussed in more detail later.

6.1.2.2 Cubic spline

Parametric and spline-based models have been widely used for yield curve estimation across international fixed income markets. The cubic splines method was developed by McCulloch and the method tries to divide the zero-coupon yield / spot curve into distinct time intervals. In each interval, a cubic spline performs as vertebra in the vertebrate spinal column. If we divide the yield curve into k–1 knot points, then we would require “k” parameters to construct the zero coupon yield curve or the spot curve. The optimal parameters that are obtained by solving the equations are used to estimate the optimal zero-coupon yield curve which would minimize the errors / difference between the model price estimated using the spline parameters and the market price of government bonds. The smoothness is ensured through application of the parameters obtained from the curve fitting. The cubic spline is a series of curves that is continuous at all the points. Each curve of

the spline is of third order and has the form $Y = ax^3 + bx^2 + cx + d$ where Y is zero-rate or spot rate for the tenor 'x'.

In India, FIMMDA uses the cubic spline function to estimate the zero coupon yield curve for Government Bonds for the day using the observed yields from the fixed income market. It uses a piecewise cubic spline function (polynomial function) that would pass through a given set of maturity coordinates (yield and time) in a smooth fashion. The function takes the form:

$$f = a_i + b_i\Delta + c_i\Delta^2 + d_i\Delta^3$$

where 'i' represents the portion of the time axis where we want to measure zero-rate. If T_i represents the time to maturity of a traded bond, then between T_i and T_{i+1}, Δ takes values from 0 to $T_{i+1} - T_i$. The time axis is divided into regions by "knot points" at times T_i (usually the traded bond maturity in years). As we can see, there is a different set of coefficients (a_i, b_i, c_i, d_i, ...) describing the zero-rate curve between every T_i and T_{i+1}. The value of the cubic spline function as well as its first and second derivatives are the same when measured from either side of the knot point.

6.1.2.3 NS and NSS model

Nelson Siegel (NS) functional form (1987) is widely used preferred parametric model by many central banks. Bank of Canada was the first to use the said functional form to estimate daily forward yields and spot yield using the bond prices from the market. This is a parametric function with four parameters for estimating the Forward Rate. Nelson, Siegel and Svensson (NSS 1994) model is improved version of 1987 NS model. Both of these models help determine the shape of the forward rates and implied spot rates. NS model has three exponential component parameters (β_0, β_1, and β_2) where as NSS model has four parameters (β_0, β_1, β_2, and β_3). These parameters are estimated to give us the level of long term and short term interest rates, slope of the yield curve and curvature to determine the extent of hump in the curve. In both the models, time is scaled by extra parameters τ_1 and τ_2 (for NS model τ_2 is not used). The function produces a smooth continuous curve with a hump along the entire tenor surface. Traded bond prices / yields with different maturities are used for estimation of the parameters describing the functional form.

The Nelson Siegel (NS) model of 1987 builds on the forward rate specification and integrates the same to get the spot rate. The original paper focused primarily on T-Bills (securities dated less than a year) and uses only monthly data.

$$fr(T) = \beta_0 + \beta_1 \frac{(1 - e^{-T/\tau 1})}{T/\tau 1} + \beta_2 (\frac{(1 - e^{-T/\tau 1})}{T/\tau 1} - e^{-T/\tau 1})$$

The initial model specification was on the forward rate which is integrated to give the spot interest rate for time T in years using β_0, β_1, β_2, and τ as estimated parameters.

The first term β_0 defines the long-term level of zero rates, because the contribution of the other two terms vanishes as T approaches infinity. It remains constant for the entire term to maturity.

The second term, β_1, introduces an exponential time decay that becomes slower the bigger τ is. It has an impact on short maturities. ($\beta_1 + \beta_0$) give the short term rate and hence β_1 is likely to be negative most of the time.

The third term, β_2, produces either a hump (if β_2 is positive) or a trough (if β_2 is negative) that occurs at a time governed by τ. Its impact increases with maturity, reaches a peak and then decays to zero.

The Nelson-Siegel model is not able to capture multiple humps which may be required at times due to the change in economic cycles. Lars Svensson in 1994, extended the N-S functional form to enable it to take one more hump along the tenors. It adds an additional term to the existing Nelson Siegel specification with an additional local extremum along the maturity profile. The model for spot rate as derived by integrating the forward rate specification is given as:

$$r(T) = \beta_0 + \frac{\beta_1(1 - e^{-T/\tau 1})}{(\frac{T}{\tau 1})} + \beta_2\left(\frac{(1 - e^{-T/\tau 1})}{(\frac{T}{\tau 1})} - e^{-T/\tau 1}\right) + \beta_3\left(\frac{(1 - e^{-T/\tau 2})}{(\frac{T}{\tau 2})} - e^{-T/\tau 2}\right)$$

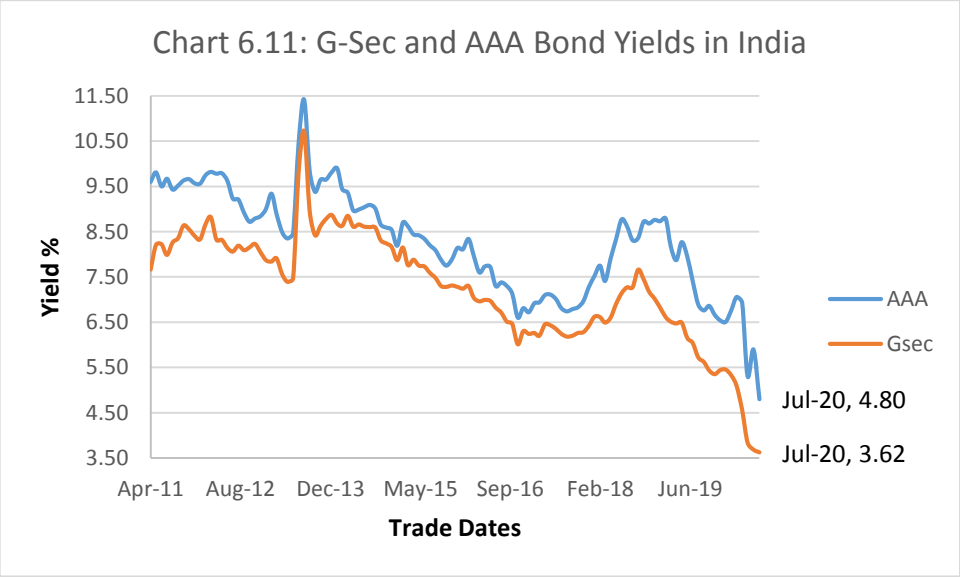
Where β_0, β_1, β_2, β_3, $\tau 1$ and $\tau 2$ are the constant parameters and T is the time in years. The terms β_3 and $\tau 2$ are the two additional parameters that provide an additional hump or a trough that provides flexibility of yield curve to be captured.

One of the most widely used parametric models, N-S model is used in India for valuation of bonds. CCIL publishes daily the Zero Coupon Sovereign Rupee Yield Curves by following a parametric approach, based on Nelson-Siegel and Nelson-Siegel-Svensson equations. For generation of the yield curves, CCIL uses the trade data for outright trades in Central Government Securities (other than special securities) and T-bills. CCIL also disseminates the sovereign yield curve based on the non-uniform rational basis spline model on a daily basis. FIMMDA publishes Zero Coupon Yield curve using Cubic Spline. The market is free to choose the spot rates depending on their need.

6.1.3 Spreads

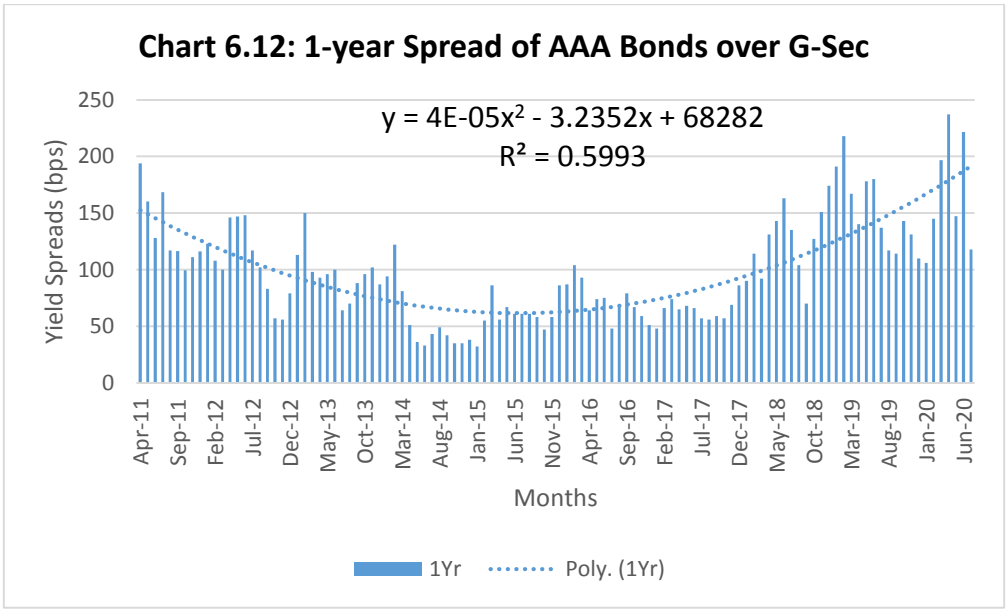
Spreads are usually charged over the yield of a risk free asset to give the yield of a risky asset for a particular maturity. This spread varies depending on the possibility of default which may be changing with time. Spreads are nothing but a risk premium for the higher risk taken by investing in a risky asset.

$$(\text{Quality/credit yield spread})_t = (\text{Yield on a risky bond})_t - (\text{G-sec yield})_t$$



Horizon spreads on the other hand are yield spreads between two bonds of equal stature, but with different maturity terms. They are usually positive because a positive horizon-risk premium is needed to entice investors into making long-term commitments. Horizon spreads can be calculated using the following equation:

Horizon spread = Yield on a long-term bond – Yield on a shorter-term bond



The Chart 6.12 depicts the Spread between the AAA bonds and comparable maturity Government bonds between April 2011 and July 2020. In good times, the spread drops below 50 bps while at stress times the yield spread increases substantially. In recent times, the ILFS and DHFL defaults led to increase in the spread as the appetite of investors dropped because of increased default risk.

If the market would like to find a trend from the above chart, a polynomial fit may be the best way to understand the trend. We have used the spread data and fitted the Polynomial to indicate the spread behavior over time.

6.1.4 Forward Rates

We may recall that a spot rate "SPOTR" represents the interest rate appropriate if you borrowed some amount "R" and had to repay it plus interest at time t, i.e. at time t you repay R(1 + SPOTR)^t . So we might borrow "R" at rate SPOTR1 for one year or SPOTR2 if it is due at the end of 2 years, etc. Suppose instead we borrow "R" for one year and then at the end of the year we borrow all that is due, namely R(1 + SPOTR1), for an additional one year period at interest rate f1. Then at the end of the second year we would owe R(1 + SPOTR1)(1 + f1). For this to be equivalent to a two year loan at an effective annual rate of SPOTR2, the rate f1 must satisfy (1 + SPOTR1)(1 + f1) = (1 + SPOTR2)^2 . Here "f1" is called a one-year forward rate because it applies to a time period of one year beginning when year one ends. In general, fn−1 is the one-year forward interest rate for money borrowed for one year beginning at the end of year n − 1.

Note also that f0 ≡ s1. For example, Spot rate for the first period of, say, 6 months and the Forward rate for 6 months starting from today (t0) would be the same.

It follows that (1 + s1) = (1 + f0)

(1 + s2)^2 = (1 + s1)(1 + f1) = (1 + f0)(1 + f1)

(1 + s3) 3 = (1 + s2) 2 (1 + f2) = (1 + f0)(1 + f1)(1 + f2)

. . . or

sn = ($\prod_{t=0}^{n-1}(1 + f_t)$^(1/n)) −1

We see from these relationships that the one-year forward rates can be derived from the spot rates and the spot rates can be derived from the one-year forward rates.

We calculate Forward Rates from the Spot rates or Zero rates. These forwards are implied forwards.

Suppose we have the following rates YTM and derived SPOT rates from the examples used earlier:

Time	YTM	SPOT
0.5	5.60%	5.60%
1.0	5.85%	5.85%
1.5	6.20%	6.21%
2.0	6.60%	6.63%
2.5	7.15%	7.22%
3.0	7.65%	7.76%
3.5	8.40%	8.61%
4.0	9.25%	9.62%
4.5	10.20%	10.80%
5.0	11.40%	12.42%

The 6 month forward rate 6 month from now would be calculated as ((((1+5.85%/2)^2*1)/(1+5.60%/2)^(2*.5)) – 1) *2 = 6.11%.

We can calculate for all other terms as per the below Table:

Time	YTM	SPOT	Forwards
0.5	5.60%	5.60%	5.60%
1.0	5.85%	5.85%	6.11%
1.5	6.20%	6.21%	6.94%
2.0	6.60%	6.63%	7.89%
2.5	7.15%	7.22%	9.58%
3.0	7.65%	7.76%	10.51%
3.5	8.40%	8.61%	13.78%
4.0	9.25%	9.62%	16.78%
4.5	10.20%	10.80%	20.53%
5.0	11.40%	12.42%	27.61%

6.2 Relationship between Spot and Forward Rates

In an efficient market, the same returns are received for investment made over one long term or multiple shorter terms by reinvesting the maturity proceeds.

For example, two year returns would be same if invested in a two year bond or by investing in a one year bond and reinvesting again for the subsequent year. The same logic can be extended for 3 year bond. In this case it is seen that there is a defined relation between the spot rates for 1 year, 2 years and 3 years, to get the expected forward spot rate for one and two years in one year's time and the expected spot one-year rate in two years' time. The

notation $y_{a,b}$ represents an anticipated forward yield in 'a' years' time for a period of 'b' years.

It should be noted that a one-year forward rate for two years is not the same as a two year forward rate for one year. The forward rates are not observed in the bond market but are implied from spot rates. If we have the following information about the Spot and Forward rates and we have to price a 10% 2 year Bond:

Maturity	YTM	SPOT RATE	FORWARD RATE
0.5	4.50%	4.50%	4.50%
1.0	4.65%	4.65%	4.80%
1.5	4.82%	4.83%	5.17%
2.0	4.99%	5.00%	5.53%
2.5	5.26%	5.28%	6.42%
3.0	5.40%	5.43%	6.16%
3.5	5.61%	5.66%	7.01%
4.0	5.83%	5.90%	7.58%
4.5	6.01%	6.09%	7.69%
5.0	6.17%	6.27%	7.89%

Using YTM:

$$V = \frac{5}{(1+{}^{4.99\%}/_{2})^{2*.5}} + \frac{5}{(1+{}^{4.99\%}/_{2})^{2*.1}} + \frac{5}{(1+{}^{4.99\%}/_{2})^{2*.1.5}} + \frac{105}{(1+{}^{4.99\%}/_{2})^{2*2}}$$

V= 109.4249. We can also get the same price using Excel formula.

Using Spot Rate:

$$V = \frac{5}{(1+{}^{4.50\%}/_{2})^{2*.5}} + \frac{5}{(1+{}^{4.65\%}/_{2})^{2*.1}} + \frac{5}{(1+{}^{4.83\%}/_{2})^{2*.1.5}} + \frac{105}{(1+{}^{5.00\%}/_{2})^{2*2}}$$

V = 109.4447. The difference is because of the rounding factors used in the interest rate up to 2 decimals.

Using Forward Rates:

$$V = \frac{5}{(1+{}^{4.50\%}/_{2})^{2*.5}} + \frac{5}{\left(1+{}^{4.50\%}/_{2}\right)*(1+{}^{4.65\%}/_{2})} + \frac{5}{\left(1+{}^{4.50\%}/_{2}\right)*\left(1+{}^{4.65\%}/_{2}\right)*(1+{}^{4.83\%}/_{2})} + \frac{105}{\left(1+{}^{4.50\%}/_{2}\right)*\left(1+{}^{4.65\%}/_{2}\right)*\left(1+{}^{4.83\%}/_{2}\right)*(1+{}^{5.00\%}/_{2})}$$

6.3 Determinants of the Shape of the Term Structure

At times the yields on short term government borrowing (say 2 year) exceed the yields on long term government borrowing (say 10 year). This is also called the yield curve inversion where long-term interest rates drop below short-term rates. The yield curve is typically upward rising because longer-term debt usually pays higher interest rates to compensate investors for the greater risk they incur waiting for repayment. Inversions can create profit margin risk for banks, hedge funds and any other financial business that borrows money at short-term rates and lends it at long-term rates. The inversion in yield curve has been considered a reliable predictor of a follow on recession or slowdown in the economy. Thus, it is important to understand the factors that influence the interest rates in the economy or in other words the term structure of interest rates in the economy.

Following are a few factors that influence the interest rates in the economy:

1. Demand for money: This will be best explained by looking at the economic activity in the market. When the economy is doing better, there will be more demand for funds and investors would be willing to take higher risk by investing in various projects. Hence, the demand for funds would see an uptick which will possibly raise the cost of money (interest rate). However, during recession when the effective demand is very low, the demand for funds from investors would be low and interest rate would show a depression.
2. Supply of money: The supply of money is typically controlled by the central bank of the country. When the inflation kicks in, the central bank would like to tighten the supply of money which will reduce effective demand and it would possibly think of increasing policy rate to make the cost of funds higher.
3. Fiscal deficit and government borrowing: When fiscal deficit is high and Government has to borrow higher amount from the market, the traders would demand higher interest rate to support such borrowing and the funds for corporates would be constrained.
4. Inflation: When inflation level increases, the savers need compensation, as the real value of their money would drop, and therefore the nominal interest rate has to be higher to compensate for the same. As inflation drops, the nominal interest rate also comes down.
5. Global interest rates and foreign exchange rates: Global investors would arbitrage between various markets. When interest rates rise in other countries, investors would move to such locations to take advantage of the higher rate of return. Hence, to attract foreign investment and to keep in sync with the global scenario, the domestic interest rate also has to increase.
6. Central bank actions: At times, the central banks raise policy rates which affect all commercial interest rates in the system. A rise in policy Repo rate would lead to increase in money market rates which will affect the bond market yields.

Sample Questions:

1. Which of the following is NOT relevant in a Sovereign Yield Curve?
   (a) Inflation Risk
   (b) Market Risk
   (c) Concentration Risk
   (d) Credit or Default Risk

   Ans: (d)

2. Normal yield curve depicts: _____.
   (a) Short term yields are flat up to 1 year and then rises
   (b) Long term yields are higher compared to short term yields
   (c) Short term yields are higher compared to medium term yields
   (d) Higher short term yields, lower medium term yields and higher long term yields

   Ans: (b)

3. Market segmentation theory depicts that _____.
   (a) Bonds of different maturities are exact substitutes for each other
   (b) Bonds of different maturities are not exact substitutes
   (c) Corporate Bonds pay higher premium
   (d) Government bonds pay safe returns

   Ans: (b)

4. The cubic spline is best defined as _____.
   (a) A series of bonds that generates continuous price points
   (b) A series of curves that is continuous at all the points
   (c) A graph depicting bonds from various rating class is used for spot curve
   (d) A series of bonds that generates continuous dots for plotting

   Ans: (b)

5. The Liquidity Premium is likely to increase with _____.
   (a) Increase in maturity
   (b) Increase in issuance size
   (c) Increase in investor base
   (d) Increase in money supply

   Ans: (a)

CHAPTER 7: MEASURING INTEREST RATE RISK

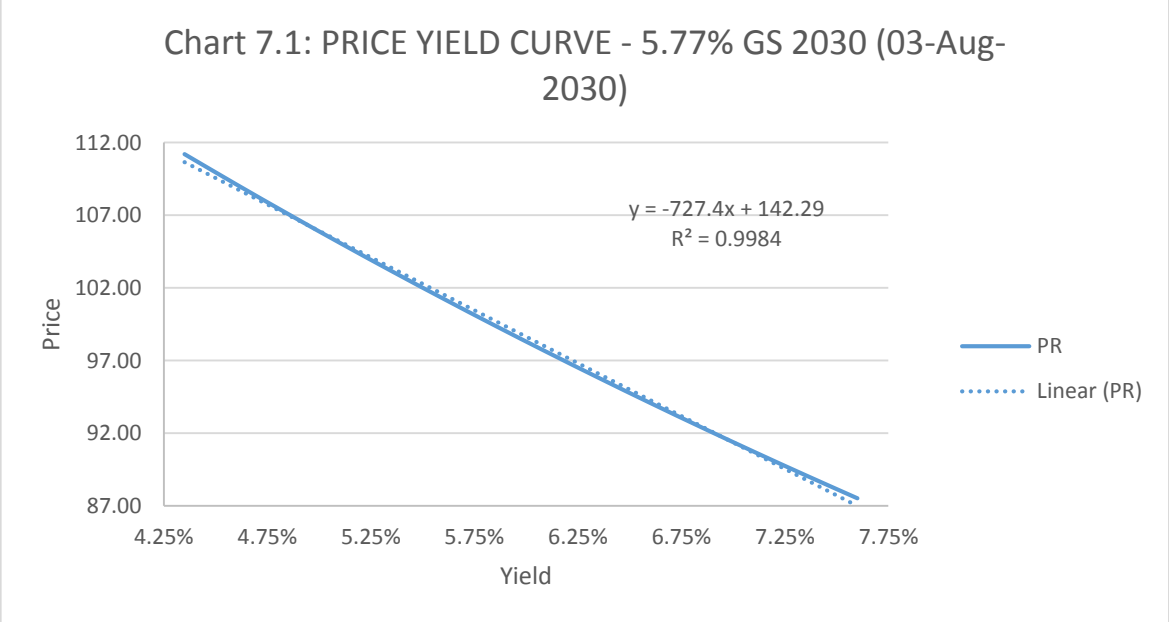
LEARNING OBJECTIVES:

After studying this chapter, you should know about:

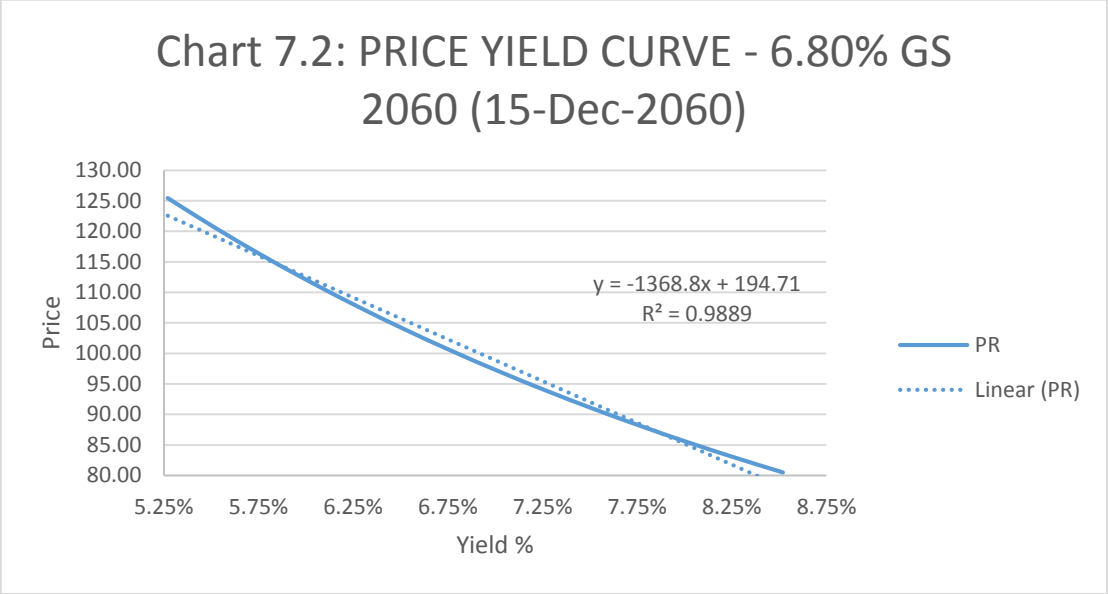
- Price Volatility Characteristics of Option Free Bonds and Bonds with Embedded Options
- Concept of Duration
- Difference between Modified Duration and Effective Duration
- Price Value of Basis Point (PV01)
- Convexity Measure
- Modified Convexity and Effective Convexity
- Taylor's Expansion and its Application in Approximating Bond Price Changes

7.1 Price Volatility Characteristics of Option Free Bonds and Bonds with Embedded Options

Interest rate risk can be defined as the change in the price or value of the bond with respect to the change in market interest rates. Each bond has a unique volatility stream with respect to change in interest rate. Volatility stream is nothing but variability in volatility or sensitivity of a bond with respect to the given yield or interest rate changes. A bond with long maturity may have higher sensitivity for a given change in interest rate vis-à-vis a shorter maturity bond. Understanding price volatility is the key to the risk management of fixed income securities. Chart 7.1 and 7.2 depicts the Price-Yield relationship for two bonds of 2030 and 2060 maturity and the same would be used by us to understand the price sensitivity of bonds.



In Chart 7.1, we have plotted the continuous Price and Yield relationship curve in a two-dimensional surface for 5.77% GS 2030 for various yields ranging from 4.25% to 7.75% for value dated 26-Oct-2020. The fitted trend line we have inserted looks linear and the fit is close to 99.84%. This may show that price changes for small changes in yield are more or less same across the curve.



In Chart 7.2, we have plotted the continuous Price and Yield relationship curve in a two-dimensional surface for 6.80% GS 2060 for various yields ranging from 5.25% to 8.75% for value dated 26-Oct-2020. The fitted trend line we have inserted looks non-linear and the fit is relatively lower at 98.89%. This may show that price changes for small changes in yield are not likely to be the same across the curve. A longer bond is expected to have higher price sensitivity compared to a short duration bond.

For same change in yield (25 bps), the change in price is different for these two bonds.

Table 7.1: Price sensitivity of Short duration and Long duration bonds (Clean Price)	
25 bps Delta Price 2030 starting with yield of 4.35% to 7.60%	25 bps Delta Price 2060 starting with Yield of 5.27% to 8.52%
2.08	4.85
2.03	4.55
1.99	4.27
1.94	4.02
1.90	3.78
1.86	3.56
1.81	3.35
1.77	3.16

1.73	2.98
1.69	2.82
1.66	2.67
1.62	2.52
1.58	2.39

In order to explain the risk of a bond price from interest rate changes, we will once again use another example: a 5.79% GS 2030 bond at two different set of market yield levels - one set of yields starting with 4.08% and ending with 7.58% with each yield change of 25bps and the other set of yields starting at 2.33% and ending at 9.33% with each yield change of 50 bps. Again, the same set of yields would be applied in the reverse direction – one set is from 7.58% to 4.08% and the other set is from 9.33% to 2.33%. This calculation would be for a settlement date of 07-Jul-2020 for semi-annual coupon paying bond 5.79% GS 2030 maturing on 11-May-2030.

This table shows that for small changes in the yield, the risk is lower while a large yield change results into higher volatility in prices. It also shows that price change is not same when yield decreases vs. when it increases. Price decreases by 1.87% when yield increases by 25 bps (i.e., from 4.08% to 4.33%) vs. price increases by 1.91% when yield decreases by 25 bps (i.e., from 4.33% to 4.25%). Following Table provides each step change in price:

Table 7.2: Price sensitivity for 5.79% GS 2030 at 25 bps and 50 bps shock to yield (Clean Price)

YLD-1	PRICE 1	CH25 % Down	CH25 % UP	YLD-2	PRICE 2	CH50 % DOWN	CH50% UP
4.08%	113.7440		1.93%	2.33%	130.2774		3.99%
4.33%	111.5951	-1.89%	1.92%	2.83%	125.2735	-3.84%	3.96%
4.58%	109.4955	-1.88%	1.91%	3.33%	120.4993	-3.81%	3.93%
4.83%	107.4439	-1.87%	1.90%	3.83%	115.9435	-3.78%	3.90%
5.08%	105.4392	-1.87%	1.89%	4.33%	111.5951	-3.75%	3.86%
5.33%	103.4802	-1.86%	1.88%	4.83%	107.4439	-3.72%	3.83%
5.58%	101.5657	-1.85%	1.88%	5.33%	103.4802	-3.69%	3.80%
5.83%	99.6947	-1.84%	1.87%	5.83%	99.6947	-3.66%	3.76%
6.08%	97.8660	-1.83%	1.86%	6.33%	96.0786	-3.63%	3.73%
6.33%	96.0786	-1.83%	1.85%	6.83%	92.6237	-3.60%	3.70%
6.58%	94.3315	-1.82%	1.84%	7.33%	89.3221	-3.56%	3.66%
6.83%	92.6237	-1.81%	1.84%	7.83%	86.1663	-3.53%	3.63%
7.08%	90.9542	-1.80%	1.83%	8.33%	83.1494	-3.50%	3.59%
7.33%	89.3221	-1.79%	1.82%	8.83%	80.2645	-3.47%	3.56%
7.58%	87.7264	-1.79%		9.33%	77.5053	-3.44%	
STDEV		0.0331%	0.0343%		STDEV	0.13%	0.14%

For a change of 25 bps in yield, we have generated the price changes and we can see the volatility level is different against the changes of 50 bps for the same bond. The volatility measured by standard deviation of price changes for 25 bps change in yield is 0.03% but for change in 50 bps in yield, the said standard deviation is about 4 times higher.

There are four basic properties with regard to the price volatility of an option-free bond:

(i) The percentage change in price due to a change in yield will be different for different bonds where their coupons, maturities and traded yields are different. For example, if we consider 5.79% GS 2030 bond as given in the prior example, when yield increases from 4.08% to 4.33%, the price drops by 1.89% but if we take another bond with the same maturity year except 8.5% coupon (8.50% GS 2030), the price drop is 1.76% when yield increases from 4.08% to 4.33%.

(ii) When yield changes are very small (say 1-2 bps), the percentage price change for a given bond remains more or less the same irrespective of increase or decrease in the yield.

(iii) When yield changes are large (say more than 20 bps viz. 100-200 bps)**,** the price change for the bond is different for the same increase and decrease in the yield.

(iv) When yields fall, the price changes are bigger than the price changes when yield rises by the same magnitude. For example, for a 5.79% GS 2030, when yield rises from 4.08% to 5.08%, the change is price in opposite direction is 7.24% but when the yield drops from 7.58% to 6.58%, the price changes in opposite direction by only 6.94%. This means, the losses due to increase in yield is less than the profit due to drop in yield for a bond even when we change the yield by the same level. These properties can be best explained using the Price-Yield curve that is convex in nature. The convexity shape of the price-yield relationship explains the difference in price changes depending on the zone of yield movement.

7.2 Understand the Concept of Duration

Duration of a bond is the time weighted average of the present value of bond's future known cash flows. It is also called weighted average maturity or the payback period of the bond. Since, the bonds have fixed maturities and cash flows come at various points in time, we need to put them in one single explanatory element to understand the relative and effective maturity of a bond vis-à-vis another as well as to understand the riskiness of the bonds. For understanding Duration, we need to understand the Price-Yield curve. The Price-Yield curve depicts the relative volatility or sensitivity of the bond across various yields surface. A Price-Yield curve is a simple depiction of price and yield relationship on a two-dimensional surface. Price and Yield are inversely related.

7.2.1 Macaulay Duration

Macaulay duration is an extremely important concept for understanding bond price sensitivity. It is the weighted average of the time to get the future cash flows from a bond. It is measured in units of years. In simple terms, this concept tells the weighted average time that we need to hold a bond in the portfolio so that the total present value of the future cash flows is equal to the current market price of the bond. Macaulay duration of a bond is influenced by the bond's coupon rate, term to maturity, and yield to maturity. With all the other factors constant, a bond with a longer term to maturity will have a greater Macaulay duration, as it takes a longer period to receive the principal payment at the maturity. Macaulay duration will decrease as time passes (term to maturity reduces). Macaulay duration is inversely related to the coupon rate. The greater the coupon payments, the lower the Macaulay duration. This is because we receive larger cash amounts (when discounted) in the early periods. A zero-coupon bond assumes the highest Macaulay duration compared with coupon bonds, assuming other features are the same. It is equal to the maturity for a zero-coupon bond and is less than the maturity for coupon bonds. Macaulay duration is also inversely related to the yield to maturity. A bond with a higher yield to maturity shows a lower Macaulay duration.

Duration (also called Macaulay duration) can be adjusted to provide us a measure of interest rate risk exposure that measures the bond's weighted average maturity. It tells us how long it would take to recover our investment and can be compared with other bonds to rank them in terms of their effective pay back periods. The weighted average maturity changes with yield changes. If interest rate increases (yield rises), the payback period comes down and vice versa. For example, the semi-annual coupon paying bond 5.77% GS 2030 (maturity 03-Aug-2030) will have a payback period of 7.50 years as on 26-Oct-2020 when the yield is 5.85%. If the yield changes to 6.50% and all other things remain the same, the payback period drops to 7.43 years.

Hence, Duration in simple terms is a measure of average time to receive all the future cash flows that will make the Present value of the said future cash flows to current market price. Zero coupon bonds will have no intervening cash flows and hence the duration and maturity would be the same.

We typically use the following formula for deriving Duration of a bond:

$$Mac\ Duration = \frac{\sum_{t=1}^{n} PV(CF_t) * t}{Market\ Price\ of\ Bond}$$

$$\text{Or, } Mac\ Duration = \frac{\sum_{t=1}^{n} \frac{t*C}{(1+Y)^t} + \frac{n*M}{(1+Y)^t}}{Market\ Price\ of\ Bond}$$

where:

Mac Duration = duration of the bond;

CF_t= cashflow at time t;

t = time period of the cashflow;
n = number of periods to maturity;
Y = the yield to maturity (market interest rate).

Duration does not increase exponentially with increase in maturity of a bond and stagnates after a maturity level is reached.

Table 7.3: Duration of Bonds with various Maturities				
Settlement Date	Coupon	Maturity	Yield	Duration
26-Oct-20	5.77%	03-Aug-30	5.85%	7.50
26-Oct-20	5.77%	03-Aug-60	6.50%	14.67
26-Oct-20	5.77%	03-Aug-90	6.80%	14.93

Duration doesn't increase in the same proportion as maturity of a bond increases. There will not be large difference between the Duration of a 30-year bond and a 40-year bond. For example, the 30-year bond 5.79% GS 2050 trading at 6.15% yield for settlement on 07-Jul-2020 would have a Duration of 14.20 years and the 40-year 5.79% GS 2060 trading at 6.25% yield for settlement on 07-Jul-2020 would have a Duration of 15.26 years.

MS-Excel can be used to demonstrate the calculation of Duration. We will use a bond 5.79% GS 2030 (semi-annual) maturing on 11-May-2030 with a yield of 5.83% on 07-Jul-2020. The Duration works out to be 7.5694 years for this bond as shown below. The Duration here is the average pay back period for the bond (in years).

Table 7.4: DURATION Calculation using Spreadsheet						
Settlement Date	Next Cashflow Date	Cashflow	Time (Years)	Discount Factor	Discounted Cashflow	Weighted Discounted Cashflow
A	B	C	D	E	F=C*E	G=F*D
07-Jul-20	11-Nov-20	2.895	0.3444	0.9804	2.8383	0.9776
	11-May-21	2.895	0.8444	0.9526	2.7579	2.3289
	11-Nov-21	2.895	1.3444	0.9256	2.6798	3.6028
	11-May-22	2.895	1.8444	0.8994	2.6039	4.8027
	11-Nov-22	2.895	2.3444	0.8740	2.5301	5.9317
	11-May-23	2.895	2.8444	0.8492	2.4584	6.9929
	11-Nov-23	2.895	3.3444	0.8251	2.3888	7.9892
	11-May-24	2.895	3.8444	0.8018	2.3211	8.9235
	11-Nov-24	2.895	4.3444	0.7791	2.2554	9.7984
	11-May-25	2.895	4.8444	0.7570	2.1915	10.6167
	11-Nov-25	2.895	5.3444	0.7356	2.1294	11.3807

	11-May-26	2.895	5.8444	0.7147	2.0691	12.0929
	11-Nov-26	2.895	6.3444	0.6945	2.0105	12.7556
	11-May-27	2.895	6.8444	0.6748	1.9536	13.3711
	11-Nov-27	2.895	7.3444	0.6557	1.8982	13.9415
	11-May-28	2.895	7.8444	0.6371	1.8445	14.4689
	11-Nov-28	2.895	8.3444	0.6191	1.7922	14.9551
	11-May-29	2.895	8.8444	0.6015	1.7415	15.4023
	11-Nov-29	2.895	9.3444	0.5845	1.6921	15.8121
	11-May-30	102.895	9.8444	0.5679	58.4390	575.2997
				DP (SUM)	100.5953	761.4442
				DURATION		7.5694
				FORMULA	761.4442/100.5953	

If we want to find out price sensitivity of this bond, we have to calculate the modified duration. Modified duration is another frequently used type of duration for bonds. Different from Macaulay duration, which measures the average time to receive the present value of cash flows equivalent to the current bond price, Modified duration identifies the sensitivity of the bond price to the change in interest rate. It is thus measured in percentage change in price. Modified duration can be calculated by dividing the Macaulay duration of the bond by 1 plus the periodic interest rate, which means a bond's Modified duration is generally lower than its Macaulay duration. If a bond is continuously compounded, the Modified duration of the bond will be equal to the Macaulay duration. In the example above, the bond shows a Macaulay duration of 7.5694, and the semi-annual yield or interest quoted for this bond is 5.83%. Therefore, the Modified duration of the bond is 7.3550 (=7.5694/1.02915). It means for each percentage increase (decrease) in the interest rate, the price of the bond will fall (raise) by 7.36%. Another difference between Macaulay duration and Modified duration is that the former can only be applied to the fixed income instruments that will generate fixed cash flows. For bonds with non-fixed cash flows or timing of cash flows, such as bonds with a call or put option, the time period itself and also the weight of it are uncertain. Therefore, looking for Macaulay duration, in this case, does not make sense. However, Modified duration can still be calculated since it only takes into account the effect of changing yield, regardless of the structure of cash flows, whether they are fixed or not. Hence, we can use the simple formula.

By definition, the Duration of a bond can be used to understand the yield - price sensitivity of the bond. It is the first derivative (change in price due to change in yield) or the slope of the Price yield curve.

For estimating duration, we not only consider the maturity over which cash flows are received but also the time pattern of interim cash flows. Hence the duration of a bond without embedded options is a measure of the sensitivity of its market price to a change in

interest rates. Bond having higher duration would mean a higher sensitivity to changes in interest rate.

We can write the bond price equation as

$$P = \sum_{t=1}^{n} C_t (1+r)^{-t}$$

A specific formula for computing duration may be obtained by taking the derivative of price with respect to 'r'. If we differentiate both sides of above equation:

$$\frac{dP}{dr} = -\sum_{t=1}^{n} tC_t (1+r)^{-t-1}$$

Multiplying the above by (1 + r),
we get:

$$(1+r)\frac{dP}{dr} = -\sum_{t=1}^{n} tC_t (1+r)^{-t}$$

Finally, divide the above equation by P and get:

$$\frac{dP/P}{dr/(1+r)} = -\sum_{t=1}^{n} t\left[\frac{C_t (1+r)^{-t}}{P}\right] = -D$$

where the expression in the square bracket is defined as weight. This is the Macaulay duration (D):

$$D = \sum_{t=1}^{n} t\left[\frac{C_t (1+r)^{-t}}{P}\right],$$

Duration is therefore the weighted average of the net present values of the cash flows. It allows us to compare the riskiness of bonds with different maturities, coupons etc. we can rewrite is as

$$\frac{dP/P}{dr/(1+r)} = -\sum_{t=1}^{n} tw_t = -D.$$

From the above equation, the negative of duration, -D, can be interpreted as the percentage change in the bond price, dP/P, induced by a change in the bond's yield, dr, scaled by 1/(1+r). In other words, we can say that duration not only measures the weighted average pay back period for the bond; it also approximates the elasticity of the value (price, or P) of the bond with respect to a change in one plus the bond's yield to maturity. Macaulay's duration is approximately equal to the negative of the elasticity with respect to a change in one plus the internal yield to maturity.

Portfolio managers use the measure of duration which is simply the percentage change in bond price, dP/P, induced by a change in yield, dr, rather than to think of it as an elasticity measure. To find this expression, we divide the equation by (1 + r), and get:

$$\frac{dP/P}{dr} = -\sum_{t=1}^{n} t\left[\frac{C_t(1+r)^{-t}}{P(1+r)}\right] = -D/(1+r) \equiv -D_m.$$

D_m is called modified duration and is used to measure interest risk. It is simply the Macaulay duration as defined divided by (1 + r). If we have semi-annual cash flows from coupon, then the same will be (1+r/2) instead of (1+r).

Duration short-cut equation for a Bond:

$$DUR = \frac{\frac{C(1+r)}{r^2}\left[1-\frac{1}{(1+r)^n}\right]+\frac{n\left(PAR-\frac{C}{r}\right)}{(1+r)^n}}{mP}$$

Where C= Coupon

R = yield

Par = Face Value of the bond

N = time to maturity

M = frequency of coupon payment

Duration short-cut calculation formula example (r = 4.5%, n = 6, Coupon = 5, Face value (Par) = 100) and market price = 102.58, payment (m) = Annual).

DUR = 5.34.

If we change the payment to semi-annual, the Duration will change to 5.27 years.

Another way of writing Macaulay Duration is the following where we use a Bond paying semi-annual coupon. If it is annual coupon paying bond, the “2” in the formula will be “1”.

$$Mac\ Duration = \frac{(1+\frac{r}{2})}{Price} * [\frac{C}{r^2} * (1 - \frac{1}{\left(1+\frac{r}{2}\right)^{2T}} + \left(100 - \frac{C}{r}\right) * (\frac{T}{\left(1+\frac{r}{2}\right)^{2T+1}})]$$

Here, Price = Dirty Price, C = Coupon, r = yield and T = time to maturity.

A bond 7.17% GS 2028 (maturity 08-Jan-2028) valued on 29-Aug-2018 (in between two

coupon paying dates) with semi-annual compounding at an yield of 7.85% with a Clean price 95.5376 and AI of 1.0158 would have a Duration of 6.84 years. DUR(C=7.17%, Y=7.85%, Freq=2, T=9.35833years, FV = 100).

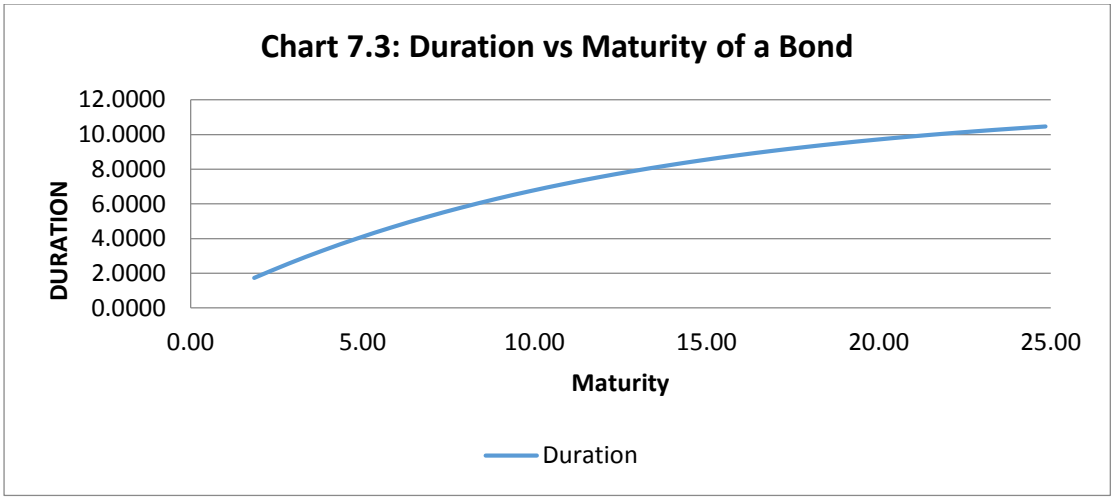
$\frac{(1+\frac{7.85\%}{2})}{(95.5376+1.0158)} = 0.010763, \frac{7.17}{7.85\%^2} = 1163.536, \quad (1-\frac{1}{(1+7.85\%/2^{2*9.35833}}) = 0.513529,$

$100-(7.17/7.85\%)$= 8.66242, $\frac{9.35833}{(1+7.85\%/2)^{2*9.35833+1}} = 4.380616$

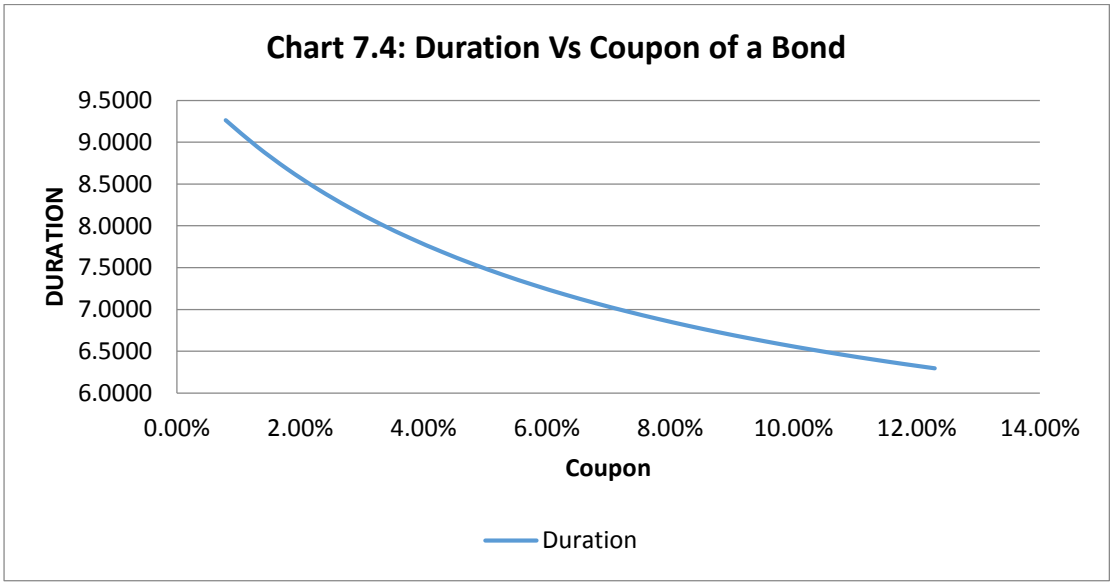
Mac Duration = (0.010763) * (1163.536*0.5135293 + 8.66242*4.380616) = 6.83972 = 6.84 years

Use of duration

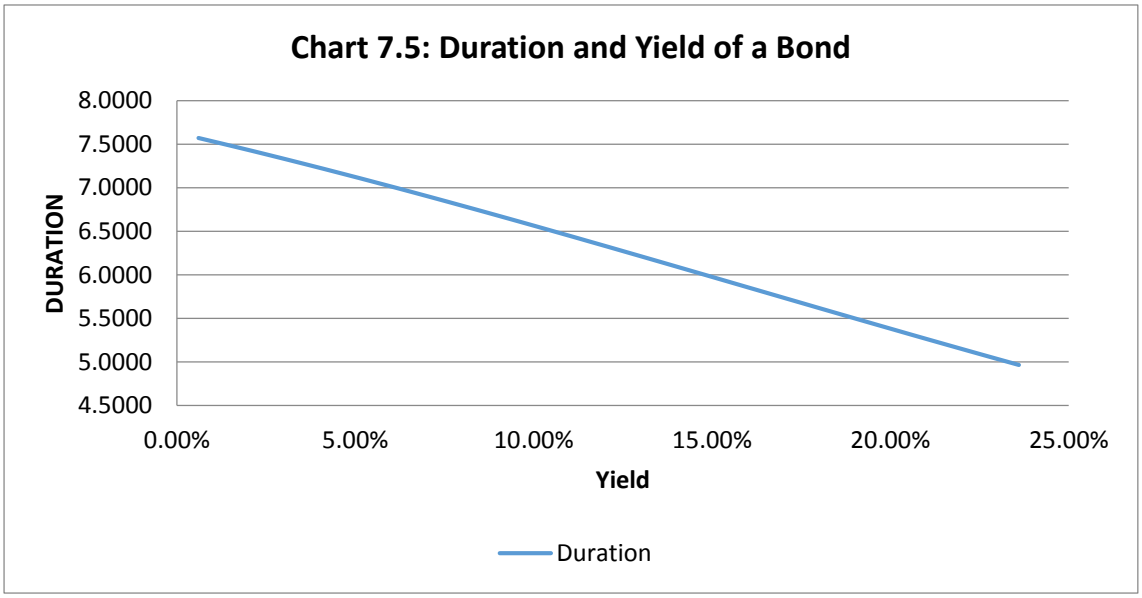
The duration-price sensitivity or elasticity depends on the maturity, coupon, and yield to maturity. All other things being equal, the longer maturity bonds are likely to have greater duration.



Higher coupon bonds are likely to have smaller duration as larger part of the cash flows will be received in early stages. Coupon payments cause weight to be put on the early years in the duration formula.



Third, duration decreases with increases in YTM. This occurs because an increase in the yield (interest rate) has a greater damping effect on the present value of a distant coupon than on the present value of a nearby coupon.



For a standard bond, duration is not infinite and the duration for a 30-year bond and a perpetual will be similar. This can be understood by looking again at the mathematics: the net present value of cash flows 30 years away are small, and the longer out, will get smaller. So, in calculating the duration, these terms will become negligible. The maximum duration for a standard bond depends on the yield environment.

The "duration gap" is a well-respected subject among banks. The gap is the difference between the Duration of asset side and the Duration of the Liability side in a particular maturity bucket. For example, a Bank may borrow money from the short term market with less than 1-year maturity but invest the same in the long term bond market of 10 year. The balance sheet will tally the Assets and Liabilities but the Duration gap would provide information as to how the risk of rollover will be managed as the bank would require the support of the lender to roll over the liability over next 10 years or so in order to match the long term asset it has created.

The formula for duration gap is:

$$D_G = D_A - \frac{MV_L}{MV_A} \times D_L$$

Where:

D_G is the duration gap (which you want to be zero if you are duration matching);

D_A is the duration of the assets;

MV_L is the market value of the liabilities;

MV_A is the market value of the assets;
D_L is the duration of the liabilities.

Some Important Duration Relationships are summarized below:

- Coupon is inversely related to Duration. Higher coupon means lower duration. This is mainly due to the fact that we receive large part of the income or cash flows at the early stage of the bond.
- YTM (yield to maturity) is inversely related to duration. Higher yield means lower Duration and vice versa.
- Duration increases with maturity.
- For zero coupon bond, duration is equal to its maturity. For simple coupon paying bond with no embedded features, duration is lower than its maturity.

7.2.2 Portfolio Duration

The duration of a portfolio is equal to the weighted average of the duration of the bonds in the portfolio.

$$DUR_{Portfolio} = \sum w_i \, DUR_i$$

Duration of a portfolio of two assets is their weighted average of Durations. If the portfolio was 30% invested in an asset with a 3-year duration and 70% invested in an asset with a 5 year duration, the duration of the two assets would be 0.3 * 3 + 0.7 * 5 = 4.40 years.

7.2.3. Modified Duration and Interest Rate Sensitivity Approximation

Modified Duration is an adjusted measure of Macaulay duration to help in the estimation of a bond's price sensitivity to changes in interest rates. It is defined as follows:

$$DUR_{\text{mod}} = \frac{DUR}{1+r}$$

Modified Duration example:

For the earlier example, DUR was 5.34. The Modified Duration would be 5.34/(1+4.5%) = 5.11. This means if the interest rate or the yield changes by 1%, the bond price is likely to change by 5.11% in opposite direction. If the bond is semi-annual coupon paying bond, the Modified Duration would be 5.34/(1+4.5%/2)= 5.22**.**

Duration as a Measure of Price Volatility:

We know that present value of a bond is estimated using the following equation:

$$P = \frac{C}{(1+r)^1} + \frac{C}{(1+r)^2} + \bullet\bullet\bullet + \frac{C}{(1+r)^n} + \frac{M}{(1+r)^n}$$

where

P	=	price of bond
C	=	Coupon cash flow per period
M	=	maturity value
n	=	frequency of coupon payment
r	=	required yield per period

In order to determine the approximate change in price for a small change in yield we first take the first derivative of P with respect to yield:

$$\frac{dP}{dr} = \frac{(-1)C}{(1+r)^2} + \frac{(-2)C}{(1+r)^3} + \bullet\bullet\bullet + \frac{(-n)C}{(1+r)^{n+1}} + \frac{(-n)M}{(1+r)^{n+1}}$$

And after rearranging the terms, we get:

$$\frac{dP}{dr} = -\frac{1}{(1+r)}\left[\frac{1C}{(1+r)^1} + \frac{2C}{(1+r)^2} + \bullet\bullet\bullet + \frac{nC}{(1+r)^n} + \frac{nM}{(1+r)^n}\right]$$

And finally dividing both sides by mP

$$\frac{dP}{dr} * \frac{1}{mP} = -\frac{1}{(1+r)}\left[\frac{1C}{(1+r)^1} + \frac{2C}{(1+r)^2} + \bullet\bullet\bullet + \frac{nC}{(1+r)^n} + \frac{nM}{(1+r)^n}\right]\frac{1}{mP}$$

$$\frac{dP}{dr} * \frac{1}{mP} = -\frac{1}{(1+r)}\ Macaulay\ \ duration\ = -Modified\ \ duration$$

It may be noted that for small changes in interest rates, the approximation produced is likely to be reasonably accurate, but for large changes this may not be true. This is because Modified Duration based price change follows linear relationship and it works well when the rate change is small. Price-Yield relationship being non-linear, large rate changes always produces smaller price changes using Duration based approach. Bond Convexity fixes this mismatch.

7.3 Difference between Modified Duration and Effective Duration

Effective Duration is an approximate price sensitivity to yield changes in a bond and is given by:

$$DUR_{eff} = \frac{(P_-) - (P_+)}{2P_0\ (\Delta k)}$$

where
$P_{\_}$ = the estimated price of the asset after a downward shift in interest rates
P_{+} = the estimated price of the asset after an upward shift in interest rates
P_0 = the current price of the asset (before any interest rate shifts
Δk = the assumed annual change in yields

We can use the same bond *(r = 4.5%, n = 6, Coupon = 5, Face value (Par) = 100) and market price = 102.58, payment (m) = Annual)*

If the yield is 5%, the Price would be 100. If the yield changes to 5.5%, the price would be 97.50.
The effective Duration for the Bond at 5% base yield = (97.50-102.58)/(2*100*0.50%) = -5.08.
This bond would possibly change by 5.08% in opposite direction if the yield changes by 1%.

We can also use the slope concept (partial derivative) to find out the effective duration. The effective duration is the change of price with respect to change in interest rate. The slope is given by $\left(\frac{dP}{dr}\right)$ (i.e., change in price / change in yield) and the same is also commonly known as Dollar duration. This is the slope of the Price-Yield curve. This type of duration is useful for measuring effects of yield change on a portfolio, rather than the magnitude of the value of an underlying bond.

Table 7.5: Effective Duration using the Slope of Price Yield Curve (First Derivative)

Settlement	Coupon	Yield	Maturity	Price	Dollar Duration $(\frac{dP}{dr})$	Effective Duration = Dollar Duration / Price
07-Jul-20	5%	5.00%	07-Jul-26	100.00		
07-Jul-20	5%	5.01%	07-Jul-26	99.95	-507.407	-5.08
07-Jul-20	5%	5.02%	07-Jul-26	99.90	-507.083	-5.08
07-Jul-20	5%	5.03%	07-Jul-26	99.85	-506.758	-5.08
07-Jul-20	5%	5.04%	07-Jul-26	99.80	-506.434	-5.07
07-Jul-20	5%	5.05%	07-Jul-26	99.75	-506.111	-5.07
07-Jul-20	5%	5.06%	07-Jul-26	99.70	-505.787	-5.07

In the above Table, the Dollar Duration was calculated as the slope of price –yield curve (change in price / change in yield) or (99.95 - 100) / (5.01% - 5%). The Effective Duration is calculated by dividing the price of the bond to get 5.08.

7.4 Price Value of Basis Point (PV01)

Price Value of a Basis Point is simply the change in price in terms of currency of the bond, if the yield changes by 1 basis point. In our above Table, the change in price is 0.05 (=100-99.95) for 1 bps change in yield. Hence, intuitively, the PV01 is Rs 0.05 or 5 paise for this bond. The PV01 or PVBP is given in terms of modified duration as well. The formula is:

PV01 = .01 * Modified Duration/100 * Bond Price = (Bond price * Modified Duration) / 10000

PV01 = (Price (Dirty) * Modified Duration) / 10000.

Here the dirty price is used as we need to understand the full value change in bond for one unit change in yield.

7.5 Convexity Measure

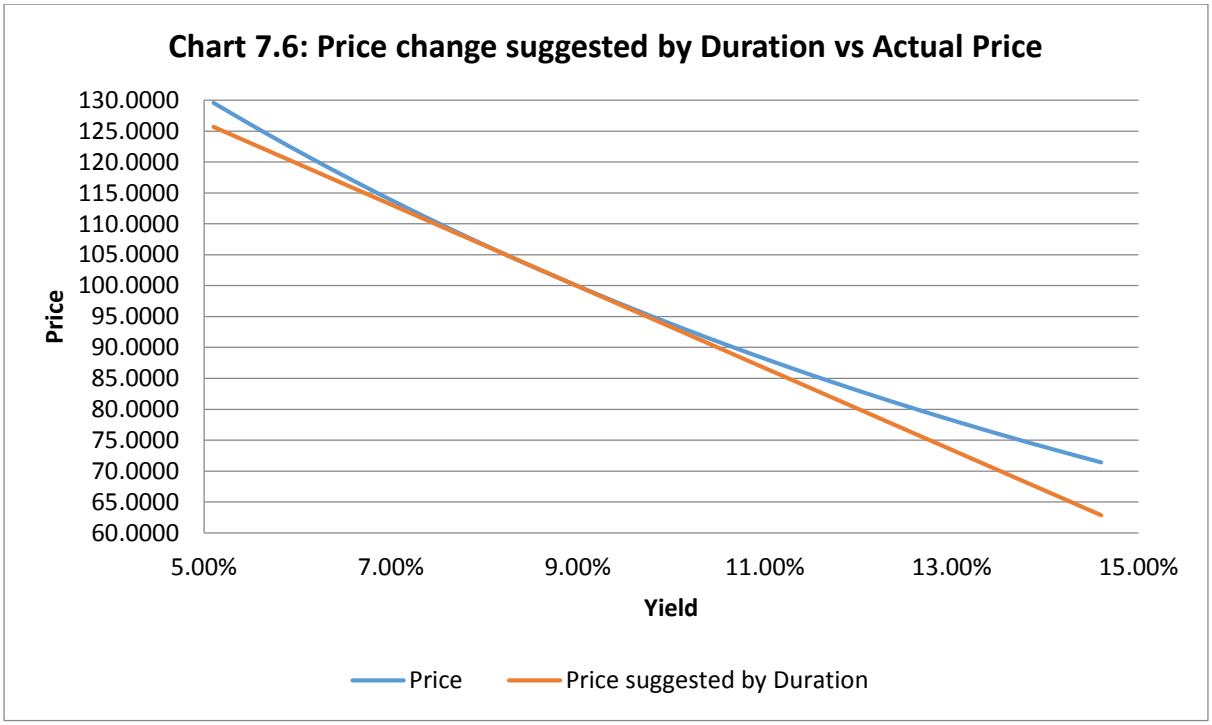
Duration is derived from the first derivative of the Bond price equation. Mathematically, duration is a first approximation of the price/yield relationship. Modified duration is an approximation of the percentage change in bond price for a given change in yield. In fact, it is accurate only for very small and parallel shifts in the yield curve. Duration can approximate price changes if the yield changes are small but when the yield changes are large, the duration does not approximate the price changes accurately. This is so because of bonds have different degree of convex shapes. When considering moderate or large changes in interest rates, a factor known as convexity is important. That is, duration attempts to estimate a convex relationship with a straight line (the tangent line). The above can be explained with the example of our Bond.

Table 7.6: Interest Rate or Yield Shock to a Bond and Modified Duration

Interest Rate shock	Actual Price Change	Price Change implied by MD	Difference (Error)
0.10%	-0.6421	-0.6610	0.0189
-0.10%	0.6477	0.6610	0.0134
0.20%	-1.2787	-1.3221	0.0434
-0.20%	1.3009	1.3221	0.0211
0.30%	-1.9099	-1.9831	0.0733
-0.30%	1.9599	1.9831	0.0232
0.40%	-2.5356	-2.6442	0.1085
-0.40%	2.6246	2.6442	0.0196
0.50%	-3.1560	-3.3052	0.1492
-0.50%	3.2950	3.3052	0.0102
0.60%	-3.7712	-3.9663	0.1951
-0.60%	3.9713	3.9663	-0.0050

0.70%	-4.3810	-4.6273	0.2463
-0.70%	4.6534	4.6273	-0.0261
0.80%	-4.9857	-5.2884	0.3027
-0.80%	5.3416	5.2884	-0.0532
0.90%	-5.5852	-5.9494	0.3642
-0.90%	6.0357	5.9494	-0.0863
1.00%	-6.1797	-6.6105	0.4308
-1.00%	6.7359	6.6105	-0.1254
1.50%	-9.0771	-9.9157	0.8385
-1.50%	10.3298	9.9157	-0.4142
2.00%	-11.8543	-13.2209	1.3666
-2.00%	14.0846	13.2209	-0.8637

The error in approximating the bond price changes using modified duration gets larger as the interest shocks become larger. Further, the increase in interest rate has a relatively lesser impact on bond price changes that the fall in interest rate. Hence, duration underestimates the price change in case of interest rate fall and over estimates the price change in case of an increase in interest rate.



The actual price change curve looks more convex vis-à-vis the linear line suggested by modified duration. Hence, we need to look at the effect of convexity on the price change to figure out better precision.

Greater precision in measuring the bond's sensitivity to yield changes can be achieved by taking into account the bond's convexity. To understand convexity, we have to remember

that a fundamental property of calculus is that a mathematical function can be approximated by a Taylor (or Maclaurin) series. The more terms of a Taylor series used, the better the approximation. We expand the bond price equation used earlier into a Taylor series (using only the first two terms):

$$dP = \frac{dP}{dr} * (dr) + \frac{1}{2} * \frac{d^2P}{dr^2} * (dr)^2 + \epsilon$$

The error term recognizes the fact that we have used only the first two terms of the Taylor series expansion. (Number two in second part of the equation is in factorial 2!, i.e., two factorial). Now, ignoring the error term and divide both sides by P.

$$\frac{dP}{P} = \frac{dP/P}{dr}(dy) + \frac{1}{2}\frac{d^2P}{dr^2}\frac{1}{P}(dr)^2$$

The fact that duration is the first term of the Taylor series can be seen by comparing the first right-hand side of equation above with other equations. The second term of the Taylor series expansion requires the calculation of the second derivative of the bond price function. Using the above analogies, we can define convexity as

The convexity measure is an approximation of the curvature. $Convexity \equiv \frac{1}{2!}\frac{d^2P}{dr^2}\frac{1}{P}$

Hence, using both duration and convexity, we can approximate the price change in the bond as:

dP/P = - Dm * dy + Convexity * (dy)2

We obtain the value of the second derivative of the bond price (dP) with respect to a change in yield (dr) by differentiating bond price equation again:

$$\frac{d^2P}{dr^2} = \sum_{t=1}^{n} t(t+1)\left[\frac{C_t}{(1+r)^{t+2}}\right].$$

Convexity varies with maturity. A longer bond is likely to be more convex than a short duration bond.

Convexity measures how the bond's duration—and by implication, its price—will change depending on how much interest rates change. Convexity is a measure of the sensitivity of a bond's price to changes in yield which is not explained by duration due to non-linear relationship between price and yield. Hence this provides a measure of the degree by which a bond's price-yield curve departs from a straight line. This measure provides better estimate of a bond's price volatility. The formula for convexity is a complex one that uses the bond price, yield to maturity, time to maturity and discounted future cash inflow of the bond. The cash inflow includes both coupon payment and the principal received at maturity.

Convexity Short Cut Calculation Formula for a semi-annual coupon paying bond would be given as:

$$CONV = \frac{\frac{2C}{r^3}\left[1-\frac{1}{(1+r)^n}\right]-\frac{2C}{r^2}\left[\frac{n}{(1+r)^{n+1}}\right]+\frac{n(n+1)\left(PAR-\frac{C}{r}\right)}{(1+r)^{n+2}}}{m^2 P}$$

Where C= Coupon, r= yield, n= time to maturity, PAR = Face value (typically 100 for India), M= frequency of coupon payment, and P = Price of the Bond.

Convexity example: Assuming a 3-yr Bond, 10% coupon, semi-annual compounding, required yield 9%, convexity can be calculated as:

$$CONV = \frac{\frac{5*1*2}{(1.045)^3}+\frac{5*2*3}{(1.045)^4}+\frac{5*3*4}{(1.045)^5}+\frac{5*4*5}{(1.045)^6}+\frac{5*5*6}{(1.045)^7}+\frac{105*6*7}{(1.045)^8}}{4 * 102.58}$$

$$= 8.2135$$

Spread Sheet Format

CFt	PV(CFt)	PV(CFt)*t	PV(CFt)*t*(t+1)/(1+r)2
5	4.7847	4.7847	8.763
5	4.5786	9.1573	25.1568
5	4.3815	13.1444	48.1471
5	4.1928	16.7712	76.7896
5	4.0123	20.0613	110.2243
105	80.6291	483.7743	3101.0464
∑	102.5789	547.6933	3370.1271
Convexity = 3370.1271 / (102.5789*4) = 8.2135			

Convexity short-cut example:

$$CONV = \frac{\frac{2\ (5)}{0.045^3}\left[1-\frac{1}{(1.045)^6}\right]-\frac{2\ (5)}{(0.045)^2}\left[\frac{6}{(1.045)^7}\right]+\frac{6\ (7)\left(100-\frac{5}{0.045}\right)}{(1.045)^8}}{4 * 102.5789}$$

$$= 8.2135$$

We can also use the spreadsheet to find out convexity of the bond. Let us take our bond 7.17% GS 2028 (maturity 08-Jan-2028) with an yield of 7.85% as on 29-Aug-2018 and semi-annual coupon payment.

Settlement	Coupon Date	Cashflow	Time (Years)	DF	DCF	DCF*Time	CONV Factor	DF	CONVEXITY CONV Fact * DF
29-Aug-18	08-Jan-19	3.585	0.3583	0.9728	3.4874	1.2497	0.0444	0.9259	0.0411
	08-Jul-19	3.585	0.8583	0.9360	3.3557	2.8803	0.1621	0.9259	0.1501
	08-Jan-20	3.585	1.3583	0.9007	3.2290	4.3860	0.3377	0.9259	0.3126
	08-Jul-20	3.585	1.8583	0.8667	3.1070	5.7739	0.5641	0.9259	0.5223
	08-Jan-21	3.585	2.3583	0.8339	2.9897	7.0507	0.8349	0.9259	0.7730
	08-Jul-21	3.585	2.8583	0.8024	2.8768	8.2228	1.1440	0.9259	1.0592
	08-Jan-22	3.585	3.3583	0.7721	2.7681	9.2963	1.4859	0.9259	1.3758
	08-Jul-22	3.585	3.8583	0.7430	2.6636	10.2770	1.8556	0.9259	1.7181
	08-Jan-23	3.585	4.3583	0.7149	2.5630	11.1703	2.2483	0.9259	2.0816
	08-Jul-23	3.585	4.8583	0.6879	2.4662	11.9816	2.6597	0.9259	2.4626
	08-Jan-24	3.585	5.3583	0.6619	2.3730	12.7156	3.0860	0.9259	2.8573
	08-Jul-24	3.585	5.8583	0.6369	2.2834	13.3770	3.5237	0.9259	3.2625
	08-Jan-25	3.585	6.3583	0.6129	2.1972	13.9704	3.9694	0.9259	3.6752
	08-Jul-25	3.585	6.8583	0.5897	2.1142	14.4999	4.4201	0.9259	4.0926
	08-Jan-26	3.585	7.3583	0.5675	2.0344	14.9694	4.8734	0.9259	4.5122
	08-Jul-26	3.585	7.8583	0.5460	1.9575	15.3828	5.3266	0.9259	4.9318
	08-Jan-27	3.585	8.3583	0.5254	1.8836	15.7437	5.7776	0.9259	5.3495
	08-Jul-27	3.585	8.8583	0.5056	1.8124	16.0553	6.2246	0.9259	5.7633
	08-Jan-28	103.585	9.3583	0.4865	50.3911	471.5764	192.5964	0.9259	178.3233
				DP	96.5534	6.8416	DUR	Total CONVΣ	223.2643
								Semi-annual	223.2643/(2^2) = 55.8161

Convexity Relationships

- Coupon is inversely related to convexity. Convexity is high for lower coupon bonds.
- Yield to maturity is inversely related to convexity. Higher Yield means lower convexity.
- Convexity is positively related to maturity of the bond. Higher the maturity, more convex is the Price-Yield curve.
- Portfolio convexity is weighted sum of individual bond's convexity.

7.6 Modified Convexity and Effective Convexity

Effective Convexity is given by the approximate formula:

$$CONV_{eff} = \frac{(P_{-}) + (P_{+}) - 2P_0}{P_0 * (\Delta r^2)}$$

where

P_{-} = the estimated price of the asset after a downward shift in interest rates

P_{+} = the estimated price of the asset after an upward shift in interest rates

P_0 = the current price of the asset (before any interest rate shifts

Δr = the assumed annual change in yields

Effective convexity like effective duration recognizes the fact that yield changes may change the expected cash flows. Modified duration and convexity assume that the yield changes do not change the expected cash flows.

For our bond 7.17% GS 2028 (08-Jan-2028 and semi-annual) valued at 7.85% on 29-Aug-2018, we can calculate effective convexity as follows:

P+ at 7.95% = 95.92043, P- at 7.75% = 97.1917, P0 at 7.85% = 96.5334 (all Dirty Price)

CONV = $\frac{(95.92043+97.1917-2*96.5334)}{96.5334*0.10\%*0.10\%} = 55.8165$

This figure is very close to what we got using the excel spreadsheet.

Modified Duration and Convexity can also be explained using simple Calculus – 1st derivative and 2nd derivative as explain below:

Settlement	Coupon	Maturity	Yield	Price	Dollar Duration	Duration	Dollar Convexity	Convexity
29-Aug-18	7.17%	08-Jan-28	7.80%	96.8719				
29-Aug-18	7.17%	08-Jan-28	7.81%	96.8081	-638.06	-6.59		
29-Aug-18	7.17%	08-Jan-28	7.82%	96.7443	-637.52	-6.59	5409.57	55.92
29-Aug-18	7.17%	08-Jan-28	7.83%	96.6806	-636.98	-6.59	5404.47	55.90
29-Aug-18	7.17%	08-Jan-28	7.84%	96.6170	-636.44	-6.59	5399.39	55.88
29-Aug-18	7.17%	08-Jan-28	7.85%	96.5534	-635.90	-6.59	5394.31	55.87
29-Aug-18	7.17%	08-Jan-28	7.86%	96.4898	-635.36	-6.58	5389.23	55.85
29-Aug-18	7.17%	08-Jan-28	7.87%	96.4264	-634.82	-6.58	5384.16	55.84
29-Aug-18	7.17%	08-Jan-28	7.88%	96.3629	-634.28	-6.58	5379.09	55.82

7.7 Taylor's Expansion and Its Application in Approximating Bond Price Changes

We can use the Taylor's expansion to figure out the price change in a bond using both modified duration and convexity.

% price change = Mod Duration * Yield change + 0.5 * Convexity Factor * (Yield change)^2

For example, our bond 7.17% GS 2028 (08-Jan-2028) trading at 7.85% for value on 29-Aug-

2018 with semi-annual coupon payment. The Dirty price is 96.5534 and AI is 1.0158. The Bond has a modified duration of -6.5920 (using approximation) and a convexity of 55.8603.

	Settlement	Maturity	Coupon	Yield	Clean Price	AI	Dirty Price	Change
P-	29-Aug-18	08-Jan-28	7.17%	6.85%	102.1721	1.0158	103.1878	6.8713%
P0	29-Aug-18	08-Jan-28	7.17%	7.85%	95.5376	1.0158	96.5534	
P+	29-Aug-18	08-Jan-28	7.17%	8.85%	89.4425	1.0158	90.4583	-6.3127%

It can be seen from the above Table that for a fall in interest rate of 1%, the change in price is +6.87% and for the rise in interest rate of 1%, the price change is -6.31%. Hence, the price changes are not uniform across the curve. The price implied by Modified Duration would be for 100 bps rise in interest rate 96.5534+(-6.5920%*(+1%)) = 90.1886. But the actual price would be 90.4583 and hence a difference of 0.2697 (=90.4583–90.1886) is explained by Convexity. Similarly, if the interest rate falls by 1%, the price implied by Modified Duration would be 96.5534+(-6.5920%*(-1%)) = 102.9181 but the actual price would be 103.1878. Hence the difference of 0.2697 (=103.1878-102.9181) is explained by Convexity of the Price-Yield curve.

If we use both Modified Duration and Convexity with the help of Taylor's expansion, we can get the implied price change for 1% rise in yield as 96.5534+96.5534*(+1%)*(-6.5920) + 0.5*55.8603 *(+1%^2) *96.5534 = 90.4583. Similarly, for a fall in yield of 1%, we will get 96.5534+96.5534* (-1%)*(-6.5920) + 0.5*55.8603 *(-1%^2) *96.5534 =103.1878.

Convexity is a very important concept like duration and for a good hedge of a portfolio we would use both Duration and Convexity. Duration is related to the slope of the Price – Yield curve (first partial derivative) while Convexity is a measure of curvature (second derivative). The true relationship between the price and the yield is a line which is convex in nature. The duration estimates the change in bond price along with the straight line that is tangent to the curved line and hence gives the same number for both rise and fall in interest rate of the same magnitude. For small yield changes for a bond, Duration gives good approximation for which we use PV01. But for large yield changes, we must use both Duration and Convexity to get the appropriate price changes.

Sample Questions:

1. PVBP represents the _____.
   (a) Change in value of a Bond or portfolio, if the yield changes by 1 bps
   (b) Change in value of a Bond or portfolio, if the yield changes by 100 bps
   (c) Change in value of a Bond or portfolio, if the yield changes by 10 bps
   (d) Change in value of a Bond or portfolio, if the yield changes by 50 bps

   Ans: (a)

2. Duration can be explained as _____.
   (a) Weighted average Coupon
   (b) Pay Back Period of cash flows
   (c) Weighted average Cash flow
   (d) Maturity in years

   Ans: (b)

3. Which of the following is correct for Modified Duration?
   (a) Percentage change in yield with respect to change in maturity
   (b) Percentage change in price with respect to change in maturity
   (c) Modified Duration is linear
   (d) Percentage change in price with respect to change in yield

   Ans: (d)

4. If the Duration of a Bond is 6.4 years, and the coupon is paid every quarter, what would be the Modified Duration of the bond, if the Bond is trading at 7% yield p.a.?
   (a) 6.40
   (b) 6.55
   (c) 6.29
   (d) 6.02

   Ans: (c)

5. If the Macaulay Duration is 6.2, Yield of the Bond is 5.8%, Coupon is paid annually and the Convexity of the bond is 65.84, what will be the percentage change in bond price, if the yield falls by 200 bps?
   (a) +13.04 per cent
   (b) -13.04 per cent
   (c) -12.17 per cent
   (d) +12.17 per cent

   Ans: (a)

CHAPTER 8: INDIAN MONEY MARKET

LEARNING OBJECTIVES:

After studying this chapter, you should know about:

- Introduction to Money Market
- Types of Instruments in Money Market
- Trends in the Indian Money Market
- Importance of the Call Money Market
- Important Rates in the Indian Inter-Bank Call Market

8.1 Introduction to Money Market

Money Market is a short-term market and handles instrument from 1 day to 1 year. It is mostly used by Government, Banks and other corporate entities to tide over short-term requirements of funds. The entities having excess and the entities with shortage of funds participate in this market. The RBI uses the money market for transmission of its monetary policy direction by changing various Reserve ratios, conducting Open Market Operations, increasing or decreasing of policy rates, etc. RBI manages systemic liquidity by either funding Banking system or absorbing excess liquidity in the system to achieve the target interest rate structure. RBI ensures that enough amount of liquidity is available in the system to make sure Banks, being the most secured entities after the Government, do not borrow at exorbitant rates in the market. It acts like a Banker of last resort by ensuring no Bank is falling short of liquidity or no bank would carry unnecessary excess liquidity in its books. RBI conducts daily liquidity adjustment facility and transmits its liquidity management through the banking system.

Globally, money market is used by central banks to moderate money supply in the economy through banking channel. Liquidity is typically pushed through banking system by central banks at the time of stress, against eligible collaterals.

Participants in the Indian money market include: Public Sector Banks, Private Sector Banks, Foreign Banks, Co-operative Banks, Financial Institutions, Insurance Companies, Mutual Funds, Primary Dealers, Bank cum Primary Dealers, Non-Banking Financial Companies (NBFCs), Corporates, Provident / Pension Funds, Payment Banks, Small Finance Banks, etc.

8.2 Types of Instruments in Money Market

Money market is typically divided into two segments: (a) Borrowing and Lending segment with or without collaterals; (b) Asset Market involving purchase and sale of such instruments. Following products are part of the Indian money market:

8.2.1 Borrowings and Lending Activities:

Instrument	Maturity	Trading & Reporting	Settlement Done by	Order Value
Call Money	Overnight	NDS-CALL	RBI	Minimum market order ₹1 lakh
Notice Money	2-14 days	NDS-CALL	RBI	Minimum market order ₹1 lakh
Term Money	15 days – 1 year	NDS-CALL	RBI	Minimum market order ₹1 lakh
Market Repo (G-Sec)	Overnight – 1 year	CROMS	CCIL	Minimum market order ₹1 crore
TREP	Overnight – 1 year	TREPS	CCIL	₹5 lakh and multiples thereof
Corporate Bond Repo	Overnight – 1 year	OTC/Stock Exchanges, Reported on F-TRAC	Authorized clearing houses of Stock Exchanges	Market lot size ₹1 crore

NDS-Call system is owned by RBI and Banks and Primary Dealers are connected to the system for executing their OTC deals through negotiation chat mode. Some Over the Counter (OTC) deals are negotiated directly between Banks and Primary Dealers outside NDS-Call system and are reported to the NDS-Call system. These deals are aggregated at the end of the day for participants and are settled on T+0 basis at the RBI in respective entities' Current Accounts.

CROMS (Clearcorp Repo Order Matching System) is the name of another system which facilitates online anonymous trading in Repo deals among mostly institutional dealers like Banks, Primary Dealers, Mutual Funds, Insurance Companies, etc. It also facilitates reporting of Over the Counter (OTC) deals that are negotiated directly between institutions outside CROMS system and are reported to the CROMS system. Typically, almost all market Repo trades are settled on T+0 basis.

TREPS (Tri Party Repo Dealing System) is the name of another system which facilitates trading in Tri-party Repo between institutional dealers. The Tri-party service is provided by a Tri-party agent like Clearing Corporation of India Ltd. Unlike normal and traditional Repo, Tri-party Repo can be traded in the market. Typically, all Triparty trades are settled on T+0 basis.

F-TRAC is the system which facilitates the reporting of Repo deals on Corporate Bond as collaterals. Trades are aggregated and netted and sent to Stock exchanges / Clearing Corporations of Stock Exchanges for settlement.

The size of the borrowing and lending market is a few times higher than the Asset segment.

8.2.2 Asset Segment

Government as well as other non-Government issuers raise funds through issuance of securities. These securities are traded in the secondary market. Cash Management Bills (CMBs) and Treasury Bills are issued by Government through RBI. Treasury Bills are of standard maturities of 91-Day, 182-Day and 364-Day while CMBs are non-standard maturity Treasury Bills upto 91 Day.

Banks and few Development Finance Institutions like SIDBI, NABARD, Exim Bank, etc. are permitted to issue Certificate of Deposits. Development Finance Institutions issue upto 3 years of maturity while Banks issue upto 1 year of maturity. These are traded in the secondary market on OTC basis and are reported to F-TRAC system for settlement at the Clearing Corporations of Stock Exchanges.

Corporates with high networth as well as the required rating can issue Commercial Papers to raise working capital funds. These are traded in the secondary market on OTC basis and are reported to F-TRAC system for settlement at the Clearing Corporations of Stock Exchanges.

Instrument	**Maturity**	**Trading & Reporting**	**Settlement Done by**	**Order Value**
CMBs	Up to 90 days	NDS-OM	CCIL	₹10,000 and multiples thereof
T-Bills	91, 182 and 364 days	NDS-OM	CCIL	₹10,000 and multiples thereof
CPs	7 days - 1 year	OTC, Reported on F-TRAC	Authorized clearing houses of Stock Exchanges	₹5 lakh and multiples thereof
CDs	Banks: 7 days - 1 year, FIs: 1 year - 3 years	OTC, Reported on F-TRAC	Authorized clearing houses of Stock Exchanges	₹1 lakh and multiples thereof

These are explained briefly below:

a) ***Call Money:*** The call money market is an avenue for unsecured lending and borrowing of funds. This market is a purely interbank market in India restricted only

to Scheduled Commercial Banks (SCBs) and the Primary Dealers (PDs). Call money transactions are dealt/ reported on the Reserve Bank of India's NDS-CALL (Negotiated Dealing System – Call) platform which is managed by CCIL and are predominantly overnight (tenor of borrowing may be extended to account for weekends and holidays).

b) ***Notice Money:*** This is an extension of the interbank call market with uncollateralized lending and borrowing of funds for a period beyond overnight and up to 14 days. Notice money transactions are dealt / reported on the RBI's NDS-CALL.

c) ***Term Money***: This is an extension of the interbank call market for uncollateralized lending and borrowing of funds for a period between 15 days and 1 year. Term money transactions are dealt / reported on the RBI's NDS-CALL.

d) ***Market Repo***: Repo, also known as a ready forward contract, refers to borrowing funds via sale of securities with an agreement to repurchase the same at a future date with the interest for the borrowings incorporated in the repurchase price. Reverse repo is the exact opposite transaction which is essentially a collateralized lending of funds. Each repo/ reverse repo deal thus has two parts (or, two legs). The repo period is the time between the two legs. The interest is computed on the actual amount borrowed by the repo seller which is the consideration amount in the repo's first leg. The lender receives the interest in the second leg when the security is bought back by the borrower at a higher consideration that includes the interest. RBI regulates the repo market in India and major participants are Scheduled Commercial Banks, Primary Dealers, Mutual Funds, NBFCs, Financial Institutions, Insurance Companies, Corporates, Provident / Pension Funds, Payment Banks, Small Finance Banks, etc.

   Repo transactions against G-secs are traded/ reported on the Clearcorp Repo Order Matching System (CROMS) electronic platform of the Clearcorp Dealing Systems. These are settled by CCIL along with the G-secs.

e) ***Triparty Repo***: "Triparty repo" is a type of repo contract with a third party intermediary between the borrower and lender known as the Triparty Agent (TPA). The TPA does the collateral selection, payment and settlement, custody and management during repo period. Following RBI's authorization to CCIL to act as a TPA, the 'Collateralized Borrowing and Lending Obligation' (CBLO) launched by CCIL on January 20, 2003 was converted into TREP on November 5, 2018. The Tri Party Repo Dealing System (TREPS), an anonymous order matching trading platform, is provided by Clearcorp Dealing Systems (India) Ltd with CCIL as the Central Counterparty (CCP) for borrowing and lending of funds against government

securities in India with a triparty arrangement. All the repo eligible entities can trade on TREPS and the funds borrowed on TREPS are exempted from RBI's CRR/SLR computation and the security acquired under the deal is eligible for SLR by the acquiring Bank. Stock Exchanges have also introduced Triparty Repo on Corporate Bonds. Unlike Repo, TREPS facilitate the trading of Repo and the seller of the security has a right to substitute the security.

f) ***Treasury Bills (T-bills)***: In India, Treasury bills or T-bills are used for short term borrowing by the Government of India and are considered to be a part of the money market as they mature within a year from issue. These are basically zero coupon securities which are issued at a discount and are redeemed at par. Normally RBI conducts weekly auctions for three tenors of T-bills: 91, 182 and 364 days. The 14 Day T-bills are not available for public consumption. RBI may use the same for parking short term surplus funds of State Governments. As per the approved investment policy, any surplus funds lying with RBI and belonging to State Governments are invested in 14-Day Treasury Bills. If the State requires money before the expiry of 14 days, the same is immediately redeemed. No instruments are issued by RBI or Government for this investment.

g) ***Cash Management Bills (CMBs)***: Essentially very short term T-bills, Cash Management Bills (CMBs) are issued by the Government of India to fund the temporary mismatches in its cash flow. CMBs have maturities less than 91 days. This is issued to absorb excess liquidity in the system after auction for usual Treasury Bills on weekly basis.

h) ***Commercial Paper (CP)***: A Commercial Paper (CP) is used by Indian corporates to raise short-term unsecured funds. CPs are also discounted instruments like T-bills and are issued for ₹5 lakh and multiples thereof for maturities between 7 days and one year. CP issuances are governed by RBI regulations. The corporate entities with a good credit rating (typically the minimum is the Second highest credit rating) and prescribed minimum networth can issue CPs. This minimum networth prescribed for CP issuance is Rs 4 crores currently. It is used as a part of working capital resources for corporates.

i) ***Certificate of Deposit (CD)***: Certificate of Deposits are issued by Banks raising wholesale deposits from depositors. These are tradable instruments as Banks taking such deposits also pay the required stamp duly. A Certificate of Deposit (CD) is issued against funds deposited at a bank or eligible Financial Institutions (FIs). CDs are issued for ₹1 lakh and in multiples of ₹1 lakh thereafter, for maturities of 7 days to one year by banks and for 1 year to 3 years by FIs.

j) **Corporate Bond Repo (CBR):** Repo in corporate bonds was introduced by RBI in 2010 and the eligible securities for CBR include:
   a. Listed corporate bonds and debentures, (however, participants cannot borrow against the collateral of their own securities or those of related entities);
   b. CPs and CDs; and
   c. Units of Debt ETFs.

Triparty repo in corporate bonds was launched in India in 2017 by stock exchanges and currently include only select AAA category bonds, A1+ rated CPs and CDs. CBR trading can be done in OTC or on stock exchanges.

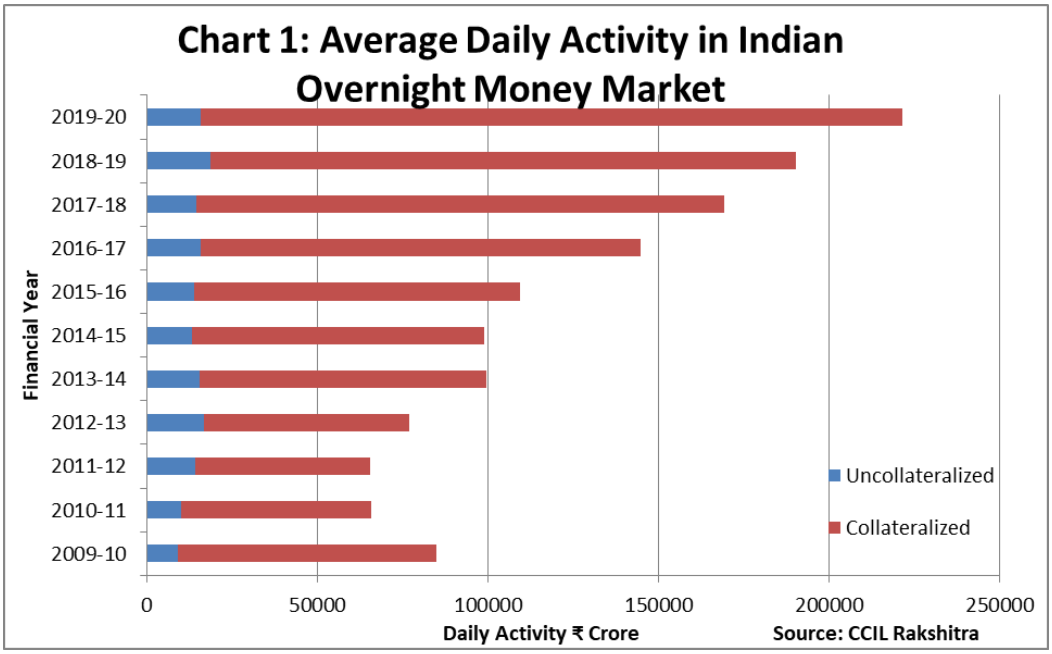
8.3 Trends in the Indian Money Market

The interbank overnight money market is dominated by primarily three instruments – call money, market repo in government bonds and TREP in government bonds. Although RBI regards the unsecured call money market as the bellwether for systemic liquidity and the operating target for its monetary policy decisions, call money accounts for less than 10% of the daily traded volumes which are dominated by the TREP segment.

Table 8.1:

Trading Activity in Money Market *(Amount ₹ Crore)*

	Uncollateralized Call, Notice and Term Money Market		**Market Repo**		**CBLO/TREP**	
Period	**Value**	**Daily Average Value**	**Value**	**Daily Average Value**	**Value**	**Daily Average Value**
2009-10	25,22,703	8,914	60,72,829	21,308	1,55,41,378	54,531
2010-11	29,45,901	10,020	40,99,284	13,943	1,22,59,745	41,700
2011-12	40,84,692	14,085	37,55,892	12,907	1,11,55,428	38,335
2012-13	48,14,032	16,658	54,02,765	18,695	1,20,28,040	41,620
2013-14	45,07,273	15,383	72,28,127	24,585	1,75,26,192	59,613
2014-15	37,40,742	12,989	78,75,244	27,440	1,67,64,597	58,413
2015-16	37,99,481	13,717	86,21,665	31,125	1,78,33,528	64,381
2016-17	42,42,821	15,714	1,18,35,001	43,833	2,29,52,833	85,010
2017-18	38,71,780	14,556	1,27,80,289	48,046	2,83,30,758	1,06,507
2018-19	50,02,364	18,596	1,35,66,142	50,432	3,25,92,056	1,21,160
2019-20	41,73,933	15,633	1,47,99,713	55,430	4,01,42,194	1,50,345
Source: CCIL Rakshitra						



In the Indian overnight money market, the borrowing side is dominated by the Primary Dealers and banks including the Public Sector Banks, Private Sector Banks and Foreign Banks, while the lending side is dominated by Mutual Funds, Co-operative Banks, Insurance Companies, Financial Institutions and others.

8.4 Importance of the Call Money Market

For the lenders, call money is the second most liquid asset after cash. In India, it enables banks to even out their day-end demand and supply of overnight funds. Banks prefer it for day-end liquidity or for reserve management because of operational ease with no collateral and low transaction costs and same day settlement of funds at RBI. Due to its unsecured nature and criticality for meeting unforeseen fund mismatches in the banking system, RBI, in August 2005 converted the call segment into a pure interbank market (including PDs).

As banks resort to borrowing in the call market to bridge unforeseen overnight liquidity mismatches arising from their day-to-day operations or for mandatory CRR requirements, the level of transactions and rates in the call market provide a strong measure of systemic liquidity. Due to this, RBI has identified the call rate as the operating target of its monetary policy. Changes in the policy rates are immediately reflected in the call rate. Call rates remain near the LAF repo rate at which banks borrow from RBI during liquidity shortage while during surplus liquidity conditions rates are nearer to the LAF reverse repo rate at which banks park surplus fund at RBI. Despite having lost its market share, it is still widely tracked due to the instantaneous and wide range of fluctuations from 0.01% to 80% that have been observed reflecting the liquidity conditions. RBI introduced the Marginal Standing Facility (MSF) for banks and PDs in 2011 to provide an informal ceiling for call rates.

RBI has issued detailed guidelines regarding the level of borrowing and lending in Call Money Market by participating entities. Borrowing from another Bank in Call Money market creates a liability in the books of the borrower and hence it is included in the Demand and Time Liabilities of the Bank. Banks have to keep their Cash Reserve Ratio and Statutory Liquidity Ratio as a percentage of their Net Demand and Time Liabilities (NDTL). RBI guidelines have been issued to help in developing the Term Money market and RBI allows banks an exemption from reserve requirements, if the Call Money borrowing is more than 15 days and less than 1 year. However, the Call Money (overnight) and Notice Money (2 to 14 days) borrowings are subject to reserve requirements. However, in contrast to Call Money market, borrowing under Repo and Tri-Party Repo do not attract any reserve requirements as these are buy and sell transactions.

The share of call money in the overnight money market has declined significantly since the conversion of the call market into a pure interbank market (including PDs) and the wider preference for collateralized instruments. However, it still remains the most important avenue for deployment of surplus day-end funds for smaller participants such as Co-operative Banks. Co-operative Banks are the largest lending group in the call money market. Their deployment of surplus day-end funds results in the rates falling significantly towards the close of trading.

8.5 Important Rates in the Indian Inter-Bank Call Market

8.5.1 MIBOR

Introduced on July 22, 2015, the Mumbai Interbank Outright Rate (MIBOR), based on overnight call money market transactions, is administered by the Financial Benchmarks India Pvt. Ltd (FBIL) with CCIL as the 'Calculation Agent'. MIBOR is notified by RBI as a 'significant benchmark' as it is the most widely used rate in India for pricing and settlement of derivatives and other contracts. MIBOR is a volume weighted average rate based on actual trades executed on the NDS-CALL platform during the first hour of trading. The trades of co-operative Banks are excluded from MIBOR calculation.

8.5.2 Weighted Average Overnight Call Money Rate – WACR

Following the recommendations made by its Working Group on Operating Procedure of Monetary Policy, RBI adopted the weighted average overnight call money rate (WACR) from May 11, 2011 as the operating target of its monetary policy which aims to contain the WACR near the LAF repo rate within the policy rates corridor. WACR is the weighted average rate for all trades executed during the entire day in the Call Market.

8.5.3 Economic Utility of Repo Market:

Repo market is used by the traders for funding their positions and taking position in the market to execute their views on interest rate. Traders short sell a security, if they think the price of the security is likely to fall due to expected increase in interest rate for a particular

segment and they borrow the said security in the Repo market to make deliveries. RBI allows short sale upto 90 days but the short selling entity has to borrow the security from the Repo market to make deliveries against the short sale. The process of transaction follows the following path:

1. The Trader has a view that the security 5.77% GS 2030 is going to face excess supply and the price is expected to fall and the trader can buy back the security after one month.
2. On 26-Oct-2020: Sale the designated security (for example 5.77% GS 2030 maturing on 03-Aug-2030 in T+1 basis in the market in the Outright market.
3. On 27-Oct-2020: Access Repo market (a trader can borrow on T+1 basis on 26-Oct-2020 as well) to borrow (buy) the security against full payment obtained from outright market.
4. On 27-Oct-2020: Deliver the security obtained in Repo market against the sell liability of 26-Oct-2020 and money is netted against the liability in Repo market.
5. The trader now carries on this transaction by rolling position on daily basis and the balance money (excess or shortage) is invested or borrowed in inter-bank call market to adjust for opportunity cost.
6. Say, after one month (26-Nov-2020), the trader's anticipation is actualized and the trader reverses his position by entering into required buy position in outright market and sell in the Repo market.

8.5.4 Example of a Repo transaction:

The trader of Bank A wants to do a Repo transaction for Rs 500 Face Value (Repo is always done on FV of the security and not on any exact money borrowed or lent) with Bank B (doing a Reverse Repo) for a security 5.77% GS 2030 (03-Aug-2030) for 15 days for value date on Oct 26, 2020. The Repo is done at a borrowing rate of 3.65% p.a. and the underlying security is being sold in the market for 5.95%. The following Table explains the First Leg transactions and transfer of consideration.

Table 8.2:

First Leg or Ready Leg Transaction of a Repo Deal	
Parameters	Value
Settlement Date	26-Oct-20
Security	5.77% GS 2030
Maturity Date	03-Aug-30
Coupon	5.77%
Yield	5.95%
Repo Days	15
Repo Maturity	10-Nov-20
Broken Period for First Leg	83
Accrued Interest	1.330305556

Clean Price	98.67033024
Dirty Price	100.0006
Face Value	500CR
First Leg Consideration	500,00,31,789.72
Clean Consideration (98.67033024*500CR/100)	493,35,16,511.94
Accrued Interest Money (1.330305556*500CR/100)	6,65,15,277.78

Banks A will deliver the Rs 500 Crore Face Value of 5.77% GS 2030 to Bank B and receive Rs 500,00,31,790 (rounded off for simplicity of understanding though Repo is priced upto 8 decimals in unit price) from Bank B. In the above transaction, the Bank A will account Rs 493,35,16,512 in Balance Sheet against the security 5.77% GS 2030. A sum of Rs.6,65,15,278 will be going to Profit & Loss Account because Accrued interest is a part of Income Statement.

In the second Leg, the transaction will reverse but the values will be different. It may be remembered that the Repo done in India is known as "Buy and Sell Back" Repo. No borrowing is shown in the balance sheet but a Buy / Sell transaction is shown in the Balance sheet of the dealing banks. Since, the reversal transaction would be executed using a Buy / Sell deal, we have to find out the implied price in the deals which will get reflected in the books of the Banks. It may be noticed that the transaction has two conventions – bond market which follows 30/360E convention and money market which follows Actual/365.

Table 8.3:

Second Leg (Forward) Transaction of Repo	
Repo interest Rate	3.65%
Repo interest Amount	75,00,047.68
Repo Settlement Date	10-Nov-20
Total Second Leg Consideration	500,75,31,837.40
Implied Dirty Price of Security	100.1506
Broken Period for Second Leg	97
Accrued Interest Amount	1.5547
Implied Clean Price	98.5959
Implied Yield on 10-Nov-2020	5.96%
Profit & Loss Account	7,77,34,722.22
Balance Sheet Amount	492,97,97,115.18

This may be noticed here that because of difference in market convention for Bond and Money market, the Broken period for the second Leg has become 97 days giving us one day less for accrued interest days vis-à-vis borrowing days in Repo.

Sample Questions:

1. Money Market is used for _____.
   (a) Financing short term asset liability mismatch
   (b) Financing long term requirements
   (c) Financing long gestation projects
   (d) All of the above

   Ans: (a)

2. The Notice Money Market is typically of _____ duration.
   (a) 2 to 7 days
   (b) 2 to 14 days
   (c) 1 to 5 days
   (d) Only overnight

   Ans: (b)

3. Banks use Call Money Market for _____.
   (a) Creating long term assets
   (b) Lending long term
   (c) Liquidity management
   (d) For CRR management

   Ans: (c)

4. MIBOR is based on _____.
   (a) Repo Market deals
   (b) Bond Market deals
   (c) Call Market deals
   (d) Tri-party Repo deals

   Ans: (c)

5. In India, _____ day count convention is followed in Repo Market.
   (a) Actual/365
   (b) 30/360
   (c) Actual/360
   (d) 30/Actual

   Ans: (a)

CHAPTER 9: GOVERNMENT DEBT MARKET

LEARNING OBJECTIVES:

After studying this chapter, you should know about:

- Basics of Government Debt Market
- Types of Instruments in the G-Sec Market
- Trends in the Indian G-Sec Market
- Issuance Mechanism
- Secondary Market Infrastructure for G-Secs in India
- Clearing and Settlement of Secondary Market Trades
- G-Sec Valuation in India
- Key Regulatory Guidelines for the Indian G-Sec Market

9.1 Introduction to Government Debt Market

The government securities (G-Sec) market is the most active segment of the Indian Fixed Income Securities market. Regular structural and infrastructural measures by the Government and Reserve Bank of India (RBI) have contributed to its substantial growth and expansion over the last two decades. Along with meeting the governments' funding needs, G-Sec Debt Market provides the benchmark interest rates in the market for pricing of various financial products, schemes and is also an indirect channel for monetary policy transmission. Table 9.1 gives the important Milestones of G-Sec market infrastructure development.

Table 9.1: Important Milestones of Government Securities Market in India

- February 15, 2002: Commenced clearing and settlement of market trades in Government Securities co-terminus with operationalisation of Reserve Bank of India's Negotiated Dealing System (NDS).
- April 10, 2002: Extended facility of guaranteed settlement for trades in Government Securities.
- January 20, 2003: Launched new Money Market Instrument – "Collateralised Borrowing and Lending Obligation" (CBLO), a repo variant with several unique features for NDS Members.
- February 15, 2003: Commenced publication of Zero Coupon Yield Curve on Website.
- April 1, 2003: All trades in the securities settlement routed through CCIL.
- June 4, 2003: Set up a wholly owned Subsidiary Company – Clearcorp Dealing Systems (India) Pvt. Ltd. to manage dealing platforms in Money and Currency Markets.
- April 2, 2004: Commenced net settlements in Government Securities as per DVP III Guidelines of Reserve Bank of India.
- August 1, 2005: Launch of Negotiated Dealing System - Order Matching Segment (NDS-OM).

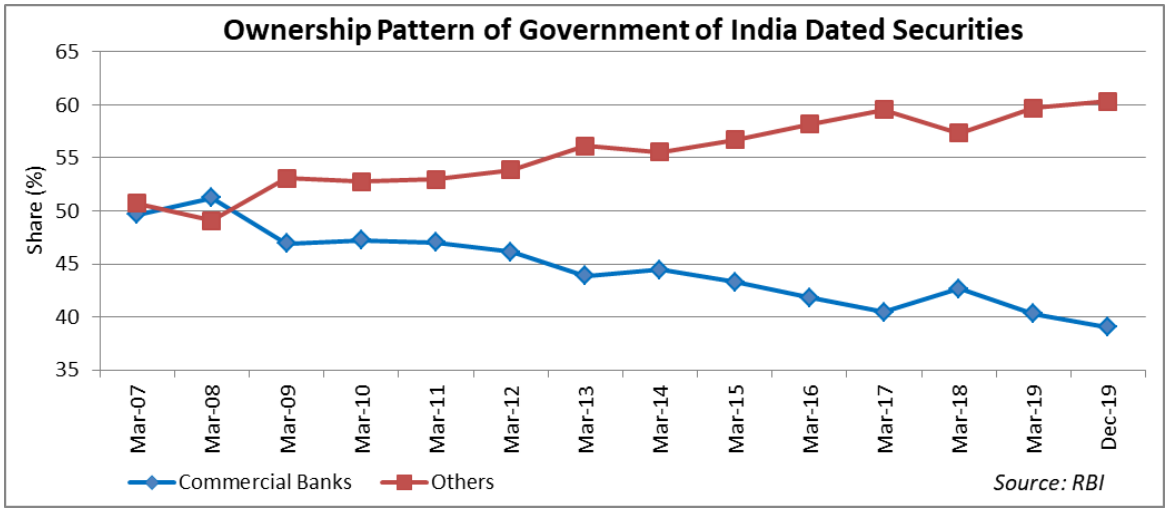
- September 18, 2006: Launch of NDS-CALL, an electronic screen-based quote driven dealing system for all Call, Notice and Term Money operations was launched.
- January 3, 2007: NDS Auction module went live to facilitate bidding in primary Treasury Bill auctions.
- August 30, 2007: Launch of CCIL's reporting platform for the transactions in OTC Interest Rate Derivatives (Interest Rate Swaps and Forward Rate Agreements (IRS/FRA) became operational.
- January 27, 2009: Launch of Clearcorp launched 'Clearcorp Repo Order Matching System' (CROMS), a STP enabled electronic anonymous order matching platform to facilitate dealing in market repos in government securities.
- February 11, 2009: CCIL became the first organization to be granted authorisation by the Reserve Bank of India under "The Payment & Settlement Systems Act- 2007".
- July 28, 2011: Portfolio Compression exercise in the OTC Interest Rate Swaps market.
- December 1, 2011: Launch of F-TRAC, for reporting deals in Corporate bonds, Corporate bond Repo and CDs/CPs.
- June 29, 2012: Web-based NDS-OM module for online trading in secondary market for Government Securities by gilt account holders (GAH) was launched.
- March 28, 2014: Launch of CCP Clearing of Rupee denominated Interest Rate Swaps and Forward Rate Agreements.
- July 22, 2015: Launch of FBIL Overnight MIBOR, with CCIL as the Calculation Agent.
- August 23, 2017: Launch of "FBIL T-Bills Curve" and "FBIL CD Curve" with CCIL as the Calculation Agent.
- December 12, 2017: Launch of FBIL MROR, Market Repo Overnight Rate, with CCIL as the Calculation Agent.

Primary participants in the Indian G-Sec market are large institutional players like banks, Primary Dealers and Insurance companies. Historically, commercial banks invest in Government securities because of Statutory Liquidity Ratio (SLR) requirement. Banks have to also invest increasingly in G-Sec as they would use it as collateral to source liquidity from the market as well as from RBI whenever the need arises. These securities are also lent by a Bank to another financial institution in the market for a fee in order to facilitate delivery of a short sale position by such borrowing entity. On many occasions, RBI conducts Open Market window for specific targeted securities and if a Bank owns the security, it can make good profit on the same. Banks also diversify their investment by buying zero risk assets like G-Secs. As per the licensing requirement, Primary Dealers (PDs) perform market making by providing firm two way (buy and sell) quotes for the Government securities in order to provide liquidity in the G-Sec market. Other participants include Co-operative Banks, Mutual Funds, Corporates, Provident and Pension Funds, Insurance Companies, Non-Banking Financial Companies and Foreign Portfolio Investors (FPIs). After the recent changes in regulations for NBFCs to achieve and maintain the targeted Liquidity Coverage Ratio, the

demand for G-Secs from NBFCs has increased. Reserve Bank of India is also a very large holder of Government securities as it has to operate market liquidity window and at times Open Market Operation. The following chart shows G-Sec ownership pattern over the time. In general, Commercial banks have been reducing ownership of G-Sec in comparison to other market entities. Table 9.2 gives the ownership pattern of G-Sec.

Table 9.2 – Ownership pattern of GOI Debt (excluding T-Bills) as per RBI website	
Month	June 2020
Total (in Rs. Crore)	67,04,983
Holding Share	%
Commercial Banks	38.98
Non-Bank PDs	0.36
Insurance Companies	26.24
Mutual Funds	2.02
Co-operative Banks	1.86
Financial Institutions	1.19
Corporates	0.78
Foreign Portfolio Investors	1.79
Provident Funds	4.96
RBI	14.70
Others (Including State Governments)	7.11
Total	100.00

Chart 9.1



9.2 Types of Instruments in Government Debt Market

A Government Security (G-Sec) in Indian markets implies a tradable debt instrument issued either by the Central Government of India or the State Governments. The Central Government issues both Treasury bills (with maturities of less than one year) and bonds, while the State Governments issue only bonds also known as State Development Loans (SDLs). G-Secs are considered risk-free. At issuance time, each security is assigned a unique ISIN (International Security Identification Number). Over the years, a variety of debt instruments have been introduced by the government to match the diverse risk appetites and investment horizons of the market participants. These instruments have been discussed in detail below.

9.2.1 Treasury Bills (T-bills)

Treasury bills or T-bills are short term money market instruments issued by the Government of India at a discount to its face value. These are zero coupon securities issued to be redeemed at par (Rs 100) at maturity. The RBI issues 91, 182 and 364 days T-Bills on behalf of Government of India. RBI conducts weekly auctions for these T-bills on Wednesdays for final allocation and credit on T+1 basis. RBI announces issuance calendar every quarter and issues the said T-bills as per the notified amount mentioned in the said issuance calendar. T-Bills are issued at a Discount to the Face Value of Rs 100. The yield is also known as a Discount Yield. There are standard Notified amounts for 91-Day (typically Rs 9000 crores), 182-Day (Rs 3000 crores) and 364-Day (Rs 4000 crores) T-Bills. The Auction is typically "Multiple Price" Auction where the Bank or institution submitting the price quote would be allocated at the quoted price subject to the success of the Bid. The price calculation uses the standard formula:

$$Price = \frac{100\ (FV)}{(1 + Yield\% * \frac{n}{365})}$$

This "n" can be 91-Day, 182-Day and 364-Day on the date of issuance. Table 9.3 gives an example of a 91-Day T-Bills Auction.

Table 9.3: Auction of T-Bills with Notified Amount of Rs 9,000 crore

Participants	F Value (CR)	Price Quote	Implied Yield	Success	Allocation Amount	Consideration
SBI	2500	99.2154	3.1719%	NO	0	0
PNB	2400	99.2234	3.1393%	YES	2400	23813616000
Citi	2600	99.2345	3.0941%	YES	2600	25800970000
HSBC	2000	99.2254	3.1312%	YES	2000	19845080000
HDFC Bank	1200	99.2186	3.1589%	YES	200	1984372000
ICICI Bank	1800	99.2195	3.1552%	YES	1800	17859510000
				Total	9000	89303548000

In the above example, HDFC Bank received Partial allotment while SBI did not receive any allocation as its Quoted Price did not come within the Cut-Off Price range of Rs 99.2185 for Rs 100 Face Value to be paid out by Government after 91 days. The cut-off Price would be

declared as Rs 99.2186 with an Implied Yield of 3.1589%. Price publication would be upto 4 decimals and so also yield publication.

9.2.2 Cash Management Bills (CMBs)

Cash Management Bills (CMBs) are T-bills maturing within 91 days but issued with non-standard maturity days. It can be for any days like 32 days, 56 Day, 86 days, etc. It was launched in 2010 in order to meet the temporary shortage in the cash flow for the Government of India as well as to absorb any excess liquidity in the system. CMBs have been extensively used by RBI for smoothening systemic liquidity issues like forex market volatility, higher level of foreign inflows to be absorbed, etc.

9.2.3 Dated G-Secs

The Securities issued by the Government to raise the financial resources are called dated securities which has fixed coupon and redemption dates. The issuances can be on the basis of Fixed Coupon rates or floating / variable Coupon rates. The variable coupons are linked to the average of 3 earlier 182-day T-bills cut-offs prior to the coupon date of the Floating Rate Bond. The Government also issues inflation indexed bonds, Sovereign Gold Bonds, special securities for payment of subsidies / grants / special considerations to targeted entities.

The Government securities are issued on the basis of the issuance calendars notified by RBI in the month of March (for sale of securities between April and September) and in the month for September (for sale of securities between October and March). The expected amounts for auction, maturity profile of securities to be auctioned, dates of possible auctions, number of securities set for auction, etc. are informed to the market well in advance through this Auction Calendar. Long term bonds are usually referred to as the dated securities and these are the largest component of the Indian G-Sec market. With maturities ranging from one to forty years, these securities pay either fixed or floating coupons on semi-annual basis. Public Debt Office (PDO) of RBI handles the issues, makes coupon payment and principal repayment on behalf of the Government. RBI is the depository of Government securities as per the legal provisions. RBI plays the role of the Merchant Banker as well as the role of Registrar and Transfer Agent (RTA) for the issue of Government securities. When coupon payment dates fall on holidays, the coupon amount is paid on the next working day. However, redemption proceeds are paid on the previous working day, if a maturity date falls on a holiday. The following types of dated G-Secs have been issued in India.

9.2.3.1 Fixed Rate Bonds

The largest component within dated securities are fixed coupon paying securities or fixed rate bonds. These securities pay a fixed coupon over their entire life, semi-annually. As an example “5.77% GS 2030” was issued on August 3, 2020 and will be maturing on August 3, 2030. This 10-year security pays a coupon every six months i.e., on February 3rd and August 3rd of each year at 2.8850% (half yearly payment being half of the annual coupon of 5.77%) of the ₹100 face value. Coupons for these bonds are fixed on the date of the issue and typically, the cut-off rate for the bond in the primary auction becomes the Coupon for the

security. As in October 2020, there are 85 fixed coupon paying SLR eligible bonds with an outstanding amount of Rs 63,91,449.36 crores with 7.95% GS 2032 Bond having the largest outstanding amount of Rs 1,21,000 crores and with 8.33% GS 2032 Bond having the lowest outstanding of only Rs 1,522.48 crore. The low outstanding may be due to the reason that this bond might have been purchased by RBI in Open Market Operations.

In Primary issuance, the Auction Calendar comes out every half year just before the beginning of the half year and Retail customers are allowed to purchase upto 5% of the notified amount with non-competitive bidding process and all such retail participants are issued securities at the cut-off rate or price.

9.2.3.2 Floating Rate Bonds (FRB)

First introduced by the Government of India in September 1995, FRBs pay interest at a variable coupon rate that is reset at pre-announced intervals. While majorly linked to the 6-month rate i.e. the 182 Day T-Bill rate, FRBs coupons at each semi-annual date are currently determined in various ways:

(a) As the average of the implicit cut-off yields of the last three 182 Day T-Bill auctions;

(b) Base rate equivalent to weighted average yield of last three 182 Day T-Bills auctions plus a fixed spread;

(c) Reset every five years at the prevailing 5-year G-Sec yield as on the last working day prior to commencement of each period of five years.

FRBs are not preferred for investment in the market. Since retail participation in the market is very low, the success of FRB is also not satisfactory. There are only 6 bonds with Variable Coupon and one of these 6 is an Inflation Indexed Bond. The total outstanding issuance as in October 2020 is around Rs 2,93,233 crores.

Valuation of Floating rate Bond is easy as we need to only value till the next coupon date as on reset date the same would be set to Rs 100. Hence, most of the time, the FRBs trade very close to their Face Value and the Effective interest rate duration of a FRB is about 6 months or less. It is like a short duration bullet bond with roll over happening every coupon reset date.

9.2.3.3 Zero Coupon Bonds (ZCB)

ZCBs do not pay any coupon and are issued at a discount while redeeming at par like T-Bills. These were last issued by Government of India in 1996. Currently, these securities are not favored in the market.

9.2.3.4 Capital Indexed Bonds (CIB)

The principal amount of a CIB is linked to an inflation index to protect it from inflation. RBI had experimented with a 5 year CIB issued in December 1997. Since then there has not been any more issuance of these bonds.

9.2.3.5 Inflation Indexed Bonds (IIBs)

In IIBs, both the principal amount and coupon flows are protected against inflation. In India, the first IIBs (linked to Whole Sale Price Index (WPI)) were issued in June 2013. In December

2013, IIBs linked to the Consumer Price Index (CPI) were issued exclusively for retail customers. However, like the Zero-Coupon Bonds and Capital Indexed Bonds, these bonds did not find wider acceptance and were discontinued after the initial issues. Government of India has repurchased most of these bonds. Currently, there is only one IIB outstanding that would mature in 2023 with only around Rs 1,152 crores of outstanding subscription.

9.2.3.6 Bonds with Call/Put Options or Embedded Option Bonds

The Government of India has also experimented with bonds with embedded options. The first such embedded option bond with both call and put options: 6.72% GS 2012 was issued on July 18, 2002 in which the Government had the right to buy-back the bond (call option) at par while the investors had the right to sell back the bond (put option) to the Government at par on any of the semi-annual coupon dates beginning July 18, 2007. Currently, Government of India does not issue any embedded option bonds. However, there are many such bonds issued by Corporates and those bonds mostly have Call option.

9.2.3.7 Special Securities

Occasionally, the Government of India issues bonds as compensation in lieu of cash subsidies to entities like the Food Corporation of India, Oil Marketing Companies, Fertilizer Companies, etc. (also known as food, oil and fertilizer bonds, respectively). Government of India also issues Bank recapitalization bonds under the special securities category. These are not eligible as SLR securities and thus pay a marginally higher yield over the yield of the similar maturity G-Secs. As in October 2020, there are 28 such special securities with an outstanding value of around Rs 1,98,703 crores.

9.2.3.8 Separate Trading of Registered Interest and Principal of Securities (STRIPS)

STRIPS are essentially separate ZCBs created by breaking down the cash flows of a regular coupon paying G-Sec. For example, when ₹100 of the 5.77% GS 2030 is stripped, the ₹100 principal payment at maturity becomes a principal STRIP while each semi-annual coupon cash flow (₹2.885) becomes a coupon STRIP. These can all then be traded separately as independent securities in the secondary market. STRIPS can be created out of all existing fixed coupon SLR eligible G-Secs. STRIPS can be attractive to retail/non-institutional investors, as being ZCBs, they have zero reinvestment risk.

9.2.3.9 Sovereign Gold Bond (SGB)

SGBs are unique instruments linked with gold price. Part of budgeted borrowing, these are issued in tranches and are denominated in units of one gram of gold and multiples thereof. They pay a fixed coupon per annum on the nominal value paid on semi-annual basis and are redeemed at simple average of closing price published by the India Bullion and Jewelers Association Limited of gold (999 purity) of previous 3 business days from the date of repayment.

9.2.3.10 Savings (Taxable) Bonds

Specially issued for retail investors at par for a minimum amount of ₹1,000 (face value) and in multiples thereof. While these bonds have no maximum limit for investment, the interest

paid is taxable under the Income Tax Act, 1961 from FY2021. These bonds bear a floating rate of interest which is reset every 6 months. These bonds are not easily tradable like FRBs.

9.2.3.11 State Development Loans (SDLs)

Market borrowings of State Governments / Union Territories through semi-annual coupon paying dated securities are known as State Development Loans (SDLs). These are eligible for SLR and borrowing under the Liquidity Adjustment Facility (LAF) window. In Primary issuance, the Auction Calendar comes out every quarter just before the beginning of the Quarter and Retail customers are allowed to purchase upto 10% of the notified amount.

9.3 Trends in the Indian G-Sec Market

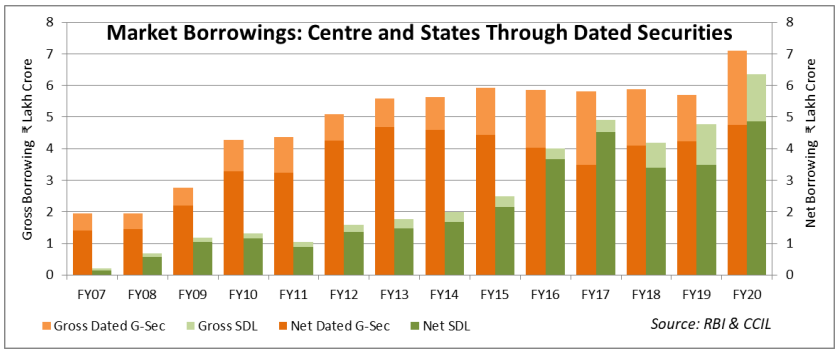
The G-Sec market is the largest segment of the fixed income market in India. Of this, dated Central Government securities account for the largest share. It is also the most liquid segment of the market.

Chart 9.2:

Total Face Value of Securities Outstanding at End-March (₹ Crore)							
Period	Government Securities	Special Securities	Floating Rate Bonds	Treasury Bills	State Development Loans	UDAY Bonds	Total
FY07	1058997	87257	44350	115474	251072	-	1557150
FY08	1288085	119948	44350	136140	302724	-	1891247
FY09	1468513	202220	44350	150274	369291	-	2234647
FY10	1787888	208214	46350	137466	517406	-	2697324
FY11	2107565	209051	49350	141327	605804	-	3113096
FY12	2544978	205657	48350	267020	742412	-	3808417
FY13	3017363	206718	43350	299764	889069	-	4456263
FY14	3468236	206718	45850	339134	1057036	-	5116974
FY15	3918504	203218	40850	363704	1273078	-	5799353
FY16	4339910	203218	23502	364692	1540428	98960	6570710
FY17	4652880	198704	61232	334802	1881996	208056	7337670
FY18	4998920	198704	125467	385283	2226427	203906	8138707
FY19	5370189	198704	177467	420882	2581708	197270	8946220
FY20	5784180	198704	237468	538411	3068720	197270	10024752
Source: RBI & CCIL							

Net market borrowings (gross borrowing during the year, less redemptions) for both the central and state governments have increased substantially. This has been managed with minimization of the cost of issuances by RBI's measures of consolidation of stock, elongation of maturity, development of a risk free yield curve, widening the investor base, planned redemption and coupon payment dates and flexibility in issuances through the green-shoe option, etc. The Green Shoe option gives the right to the issuer, i.e., the Government of India, to retain a pre-decided additional amount, if the demand for the securities in the auction is substantially high. Currently, Green Shoe options are regular feature of Auction process for Government of India dated securities auction.

Chart 9.3:



RBI does Active consolidation by buyback/conversion of the existing illiquid securities (for example 8.33% GS2033). For passive consolidation, it has focused on building outstanding amount in a few securities at various maturity points through repeated reissuances or reopening of the issues. Typically, almost all issues are reopening of the existing issues and only a few new issues are done in a year. By reissuances, the outstanding stock of the existing securities increase in the market that helps to create liquidity in the Bond. This also helps in elongation of the liquid life of securities which in turn improves overall market liquidity. This has also helped in creation of a benchmark risk-free yield curve (1 to 40 years of maturities). India has one of the longest weighted average debt maturities globally (11.34 years for 85 vanilla semi-annual coupon paying bonds as on 09-Oct-2020), helping to limit the rollover risk. The weighted average maturity is arrived at multiplying outstanding amount of the security with its outstanding maturity and divided by the total amount of outstanding borrowings of the Government under those securities. Since large number of securities are available across almost all maturities upto 40 years, the chance of one bond replacing another bond is very remote. Roll over is required when the Government does not have enough amount of funds and would like to borrow with new instruments or securities to repay the old loans maturing. Shorter duration of maturities create roll over risk for the Government and it can have implicit higher cost of borrowing not only for the Government but also for all entities.

Chart 9.4:

Maturity Profile of Central Government Dated Securities Outstanding at End-March

Period	0-5 Years		5-10 Years		10-15 Years		15-20 Years		20-25 Years		25-30 Years		>=30 Years		Weighted Average Maturity of Outstanding (Years)
	Number of Securities	Outstanding (₹ crore)	Number of Securities	Outstanding (₹ crore)	Number of Securities	Outstanding (₹ crore)	Number of Securities	Outstanding (₹ crore)	Number of Securities	Outstanding (₹ crore)	Number of Securities	Outstanding (₹ crore)	Number of Securities	Outstanding (₹ crore)	
FY06	51	302493	32	293722	15	200465	6	93688	2	26000	4	60350	-	-	9.38
FY07	45	373735	30	359288	15	181210	5	57076	4	49687	4	82350	-	-	9.99
FY08	43	503458	28	416285	16	195942	7	64756	4	38644	4	113350	-	-	9.46
FY09	40	503492	30	533310	12	174310	7	78756	5	120644	4	102350	-	-	9.77
FY10	45	642797	24	590381	13	223998	6	98068	7	206994	2	72000	-	-	9.68
FY11	45	768603	22	666465	10	249785	5	137068	8	289994	2	45000	-	-	9.64
FY12	43	971904	26	897675	9	273756	7	185644	4	161350	3	103000	-	-	9.60
FY13	42	1107021	25	937942	11	445756	5	227644	4	188350	4	154000	-	-	9.67
FY14	42	1167054	23	1002810	10	554756	7	380644	4	151350	4	257472	-	-	10.00
FY15	38	1259948	23	1166498	9	536557	10	529878	3	189000	4	277472	-	-	10.23
FY16	35	1295267	22	1272237	11	726442	10	575994	2	103000	5	381472	1	9000	10.50
FY17	35	1490820	22	1421527	13	831423	7	387870	3	193000	5	350472	2	39000	10.65
FY18	34	1446187	22	1636510	11	896818	7	461870	4	297529	4	293472	2	92000	10.62
FY19	35	1748192	20	1551255	14	1145613	5	296595	4	364002	3	295000	2	147000	10.40
FY20	36	1941165	20	1711670	15	1213197	4	227151	6	506002	2	184000	3	238462	10.72

*Excluding Special Securities Source: RBI & CCIL

9.4 The Issuance Mechanism

In June 1992, Government of India introduced auction of dated securities, thus making its borrowing at market determined rate. Auction process ensures most efficient price/yield and addresses the associated rollover and market risks. RBI as the governments' debt manager plans primary issuances to simultaneously aid the development of the secondary market. A liquid secondary market is necessary to manage market yields and thereby the interest rate risk for the issuers as all new market borrowings (whether to finance the gross fiscal deficit or for rollover of redemptions) happen at the prevailing market yields. With the withdrawal of RBI as the underwriter or buyer of the last resort from auctions, the primary auction market became fully market determined from April 1, 2006.

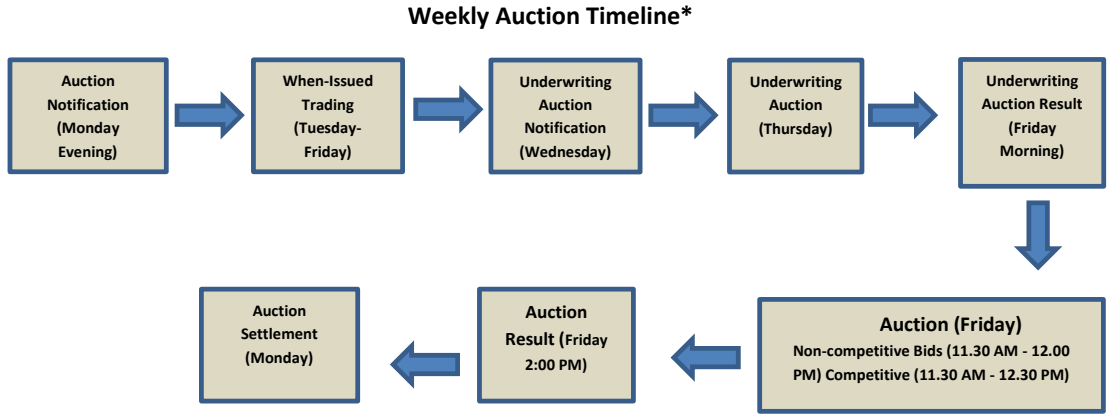
9.4.1 Primary Market and Government Borrowing Programme

RBI generally issues an indicative auction calendar in March and September for the next six months after consultation with the Government of India. This gives the market a broad idea of the expected quantum of borrowing, auction dates and the tenor of securities. RBI also releases quarterly indicative calendars for SDL and T-Bill issuances at quarter end for the next quarter. As an example by end of June, it notifies calendar for July-September. About a week prior to the actual date of auction, RBI notifies the exact particulars of the upcoming auction i.e., name and amounts of the securities, type of issue and auction procedure. This is also advertised in leading newspapers (English and Hindi for G-Sec and T-Bills and also in vernacular newspapers of participating States for SDLs). Cash Management Bills (CMB) auctions are announced directly on the RBI website without a calendar as they depend upon the temporary cash requirements of the Government. Auctions are currently conducted by RBI on T+1 (i.e., next day) settlement basis on the E-Kuber electronic platform which is a part of its Core Banking Solution (CBS) platform.

Auction for dated securities is normally conducted on Fridays with the underwriting auctions for PDs on the preceding day (i.e., on Thursdays), with settlement on Mondays. Weekly auctions are held for 91 day, 182 day and 364 day T-bills on Wednesdays, while SDL auctions are generally held on Tuesdays. The following is a diagrammatic representation of the auction process for dated G-Secs.

A "When Issued Market" has been set up as a part of market development wherein traders can resell or redistribute their stocks which are likely to get allocated in the upcoming Auction. This also helps in the price discovery process for new issuances that are going to happen shortly. It allows short sale of the security with various limits. However, there is no margin or settlement of these trades till the Final settlement of outright market deals that happens after the Auction process is over.

Chart 9.5:



***Assuming normal week with no intervening holidays.**

9.4.2 Auction Mechanism

RBI decides the appropriate auction type based on the market conditions and informs the market about the same in advance in the respective auction notification. The various types of auctions currently being conducted by RBI are:

1. Yield Based Auction: This is generally conducted for a new security. Investors bid in yield terms up to two decimal places (e.g., 5.77%, 5.79%, etc.). Bids are arranged in ascending order and the cut-off yield is arrived at the yield corresponding to the notified amount of the auction. This cut-off yield gets set as the security's coupon rate. Bids higher than the cut-off yield are rejected.

Table 9.3: Yield Based Auction of a New G-Sec 10 year with Notified Amount of Rs 6,000 crore

Participants	Face Value (Rs crores)	Yield Quoted	Implied Price	Success	Allocation Amount	Consideration
SBI	1500	5.8505%	100.2210	YES	1500	15033145055
PNB	1000	5.8708%	100.0688	YES	1000	10006884692
Citi	1200	5.8523%	100.2075	YES	1200	12024896038
HSBC	1100	5.8621%	100.1340	YES	1100	11014740682
HDFC Bank	2200	5.8800%	100.0000	YES (Partial)	660	6600000000
ICICI Bank	1800	5.8800%	100.0000	YES (Partial)	540	5400000000
				Total	6000	60079666467

The above Table shows the details of Auction of a New security using Yield based Auction mechanism (multiple price). The traders have quoted different yields and the cut-off is 5.88% which is going to be the Coupon for the New Bond which will start on 26-Oct-2020 and matures on 26-Oct-2030. Since SBI quoted 5.8505%, they would pay at 100.2210 while HDFC Bank and ICICI Bank would pay at cut-off rate with implied price of 100. Both HDFC Bank and ICICI Bank would get partial allocation on the basis of their application using a simple formula: (Application / Total Application at that Price) * Total amount available for

allocation in Auction. In this example, HDFC Bank applied for 2200 crores and ICICI Bank applied for 1800 crores at 5.88% which was the cut-off rate in the auction. After full allocation (SBI, PNB, Citi and HSBC), only 1200 crores was left to be allocated to the remaining successful bidders. Therefore, HDFC Bank would get (2200/4000)*1200 = 660 crores and ICICI Bank would get (1800/4000)*1200 = 540 crores. Since HDFC Bank and ICICI Bank have quoted the same rate in the Auction, they would get at the said rate.

2. Price Based Auction: This is used for reissuances of existing securities. Bidding is in terms of price for the par value of the security (e.g., ₹105.00, ₹103.00, ₹98.00, etc., per ₹100). Bids are arranged in descending order of price offered and ones below the cut-off price are rejected.

Table 9.4: Price Based Auction of G-Sec (5.77% GS 2030) with Notified Amount of 6000CR

Participants	F Value (CR)	Price Quote	Implied Yield	Success /(Partial)	Allocation Amount	Consideration
SBI	1500	99.44	5.8446%	YES (Partial)	851.35	8579093581
PNB	1000	99.45	5.8433%	YES	1000	10078030556
Citi	1200	99.43	5.8460%	NO		0
HSBC	1100	99.46	5.8419%	YES	1100	11086933611
HDFC Bank	2200	99.44	5.8446%	YES (Partial)	1248.65	12582670586
ICICI Bank	1800	99.53	5.8324%	YES	1800	18154855000
				Total	6000	60481583333

The above security is being issued on October 24, 2020 and the value date is October 26, 2020. The security is issued with a notified amount of Rs 6000 crores. Assuming no retail participation in the auction, all are allocated to non-retail participants.

Auctions are classified as Multiple/Uniform price auctions based on the price paid by successful bidders. When all the successful bidders are required to pay at the auction cut-off rate, it is a uniform price auction; while when successful bidders pay at the respective price/yield at which they have bid, it is termed a multiple price auction. The choice of multiple vs. uniform price auctions is made by RBI based on underlying market conditions. The minimum bid amount is ₹10,000 and in multiples of ₹10,000 thereafter.

Auction Participants can bid under two categories based on their eligibility:

- Competitive Bidding: It is meant for well-informed institutional investors where they bid at a specific price/yield and get allotment, if their quotes are within the cut-off price/yield. Such participants including banks, PDs, insurance companies, financial institutions, and mutual funds can put in multiple bids at various prices/yield levels.
- Non-Competitive Bidding (NCB): Specially provided for small and retail investors, NCB is open to participants who do not have a current account or Subsidiary General Ledger (SGL) account with RBI and submit their bid indirectly through an Aggregator/Facilitator such as Scheduled banks, PDs and specified stock exchanges.

SGL accounts are meant to hold the G-Secs of the entities who own the securities and the same is maintained at RBI. Constituents maintain a sub-account called Constituent SGL account with a SGL service provider. Allocation under Non-Competitive Bidding (NCB) is made at the weighted average yield/price that emerges on the basis of the competitive bidding and is restricted to a maximum of 5% of the notified amount for G-Secs and T-Bills and 10% in the case of SDLs. This scheme has not been extended to Cash Management Bills (CMBs). NCB is open for any person permitted by RBI including individuals, firms, companies, corporate bodies, institutions, provident funds and trusts. The Government has also permitted participants such as State Governments, eligible Indian provident funds, the Nepal Rashtra Bank and the Royal Monetary Authority of Bhutan to put non-competitive bids in T-Bill auctions without any restriction on the maximum amount and these bids are outside the notified amount. For their statutory obligations, Regional Rural Banks (RRBs) and Cooperative Banks can also directly submit such bids only in the auctions of dated securities. Only single bids are permitted under NCB.

9.4.3 Underwriting Provisions

In March 1996, RBI introduced a system of primary dealers (PDs) that had bidding commitments and offered two way quotes for ensuring the success of primary auctions and improving liquidity in the secondary market. The PDs have to underwrite the issuances of the Government securities and Treasury Bills issued by Government of India. The Underwriting fees are decided on the basis of an auction which is conducted before the auction of the government securities. Each primary dealer has to compulsorily underwrite 2.5% of the Notified amount for each security which is commonly known as Minimum Underwriting Commission. The PDs bid for additional underwriting commitment for which they are paid underwriting fees. The commission payable to PDs is determined through competitive bidding and is a necessary cost of insurance for safeguarding the success of auctions. The commission charged by PDs is a good measure of sentiments in the bond market as it reflects the demand for the securities.

9.4.4 Institutional Participants

Participants with funds account (current account) and securities accounts (SGL account) with RBI, are members of E-Kuber and include commercial banks, PDs, insurance companies, scheduled Urban Cooperative Banks and provident funds. All non-E-Kuber members participate in primary auctions through their Gilt Accounts maintained with a Primary Members (PM) which may be a scheduled commercial bank or a PD. PMs' proprietary transactions are settled through SGL account maintained with RBI while transactions undertaken for their Gilt Account Holders (GAHs) are settled through their Constituent Subsidiary General Ledger (CSGL) account with RBI.

9.4.5 Foreign Investors

Foreign Portfolio Investors (FPIs), subject to the quantitative limits prescribed for them from time to time, are allowed in the Indian G-Sec market. RBI has also introduced a separate channel, called the 'Fully Accessible Route' (FAR), to enable non-residents to invest in specified Government of India dated securities without being subject to any investment ceilings.

9.4.6 Retail Investors

As discussed above, the scheme of NCB (Non-Competitive Bidding) was introduced in January 2002 to encourage investors lacking sufficient expertise to participate in the primary G-Sec auctions without having to quote the yield or price in the bid. Retail participation is also facilitated through the stock exchanges.

9.5 Secondary Market Infrastructure for G-Secs in India

The secondary market for G-Secs in India is very active with diverse groups of market participants. The infrastructure for trading and settlement is one of the best in the world which has supported the market's growth and expansion. Secondary market trading takes place through:

- Negotiated Dealing System-Order Matching (NDS-OM): In August 2005, RBI introduced an anonymous screen-based electronic order matching module called NDS-OM. Participants can trade anonymously by placing their orders on the system or by accepting the orders already placed by other participants. This anonymity ensures a level playing field for various categories of participants due to price transparency and better price discovery. NDS-OM is operated by Clearcorp Dealing Systems Limited, a wholly-owned subsidiary of CCIL, on behalf of RBI. Direct access to the NDS-OM system is available to large institutional participants like banks, PDs, etc. while other participants get indirect access through their custodians / Primary Members i.e., with whom they maintain Gilt Accounts. Retail (individual) investors having demat accounts can access through any of the existing Primary Members of NDS-OM who also act as Depository Participants.
- Over the Counter (OTC)/Telephone Market: G-Sec trading in India can also be done over telephonic negotiations with a bank / PD / financial institution either directly or through a SEBI registered broker. All such trades have to be reported on the Reported segment of NDS-OM within 15 minutes of striking the deal.
- NDS-OM-Web: This was launched by RBI on June 29, 2012 to enable Gilt Account Holders (GAHs) to control their orders and get access to real time live quotes on NDS-OM through their Primary Members only as risk controllers.
- Stock Exchanges: Stock exchanges have dedicated debt segments in their trading platforms to cater to the needs of retail investors.

9.5.1 The NDS-OM Trading Platform

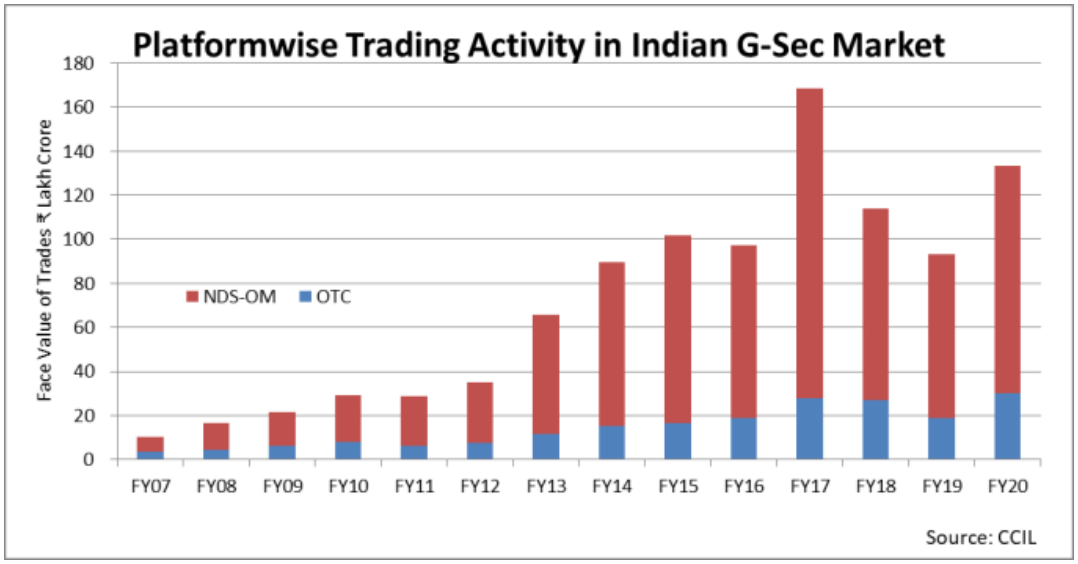
RBI introduced the Negotiated Dealing System (NDS) on February 15, 2002 which resulted in significant improvements in transactional efficiency and transparency. On August 1, 2005, RBI launched its anonymous order matching G-Sec trading platform, Negotiated Dealing System-Order Matching (NDS-OM). Currently secondary market trades in the Indian G-Sec market are either conducted or reported on the NDS-OM trading platform.

9.5.1.1 Trading

Participants place orders of 'bid' (for purchase) or 'offer' (for sale) or two way quotes for the desired securities (amount and price) on the NDS-OM, which matches such inter-entity (different participants) bids and offers of the same prices with time priority. Once orders are matched, the trade details flow seamlessly from trading to settlement within a straight-through-processing (STP) framework of CCIL.

The NDS-OM system has separate screens for trading of the dated G-Secs, SDLs and T-Bills (including Cash Management Bills). In addition, there is a screen for odd lots for facilitating trading by small participants in smaller amounts of less than ₹5 crores with the minimum size of ₹10,000. Due to anonymity offered by the system, the pricing is not influenced by the participants' size and standing. Availability of both pre-trade (e.g., bids/offers) and post-trade (e.g., last traded price and volume) information on real time basis assures transparency and better price discovery. Participants get to know the depth of the market as the system shows the order depth in terms of number and total amount of sell/ buy orders for each security. NDS-OM gives a high level of operational ease and trades are automatically confirmed for settlement. G-Sec market activity in India has received significant support from the transparency from and various functionalities added to NDS-OM which has also enabled RBI to migrate to the on-line monitoring of all Foreign Portfolio Investors activity in G-Sec market.

Chart 9.6:



NDS-OM has helped RBI to open up the largely wholesale G-Sec market to smaller participants using odd lot market segment where smaller lots can be bought and sold.

9.5.1.2 Reporting

RBI mandates reporting of all G-Sec trades negotiated in the OTC/Telephone market within 15 minutes on the NDS-OM platform (Negotiated Dealing System). This reporting is a 2-stage process wherein both the buyer and seller report their respective legs of the trade which is then validated by the system after matching all the parameters reported by both the parties. Reporting on behalf of GAHs is done by their respective custodians.

9.6 Clearing and Settlement of Secondary Market Trades

The Clearing Corporation of India Limited (CCIL) was set up in April 2001 for clearing and settlement of all the secondary market trades in G-Secs in India. CCIL also guarantees the settlement through the process of novation whereby it becomes central counter-party (CCP) to every trade i.e., it becomes seller for each buyer and buyer to each seller. CCIL forwards the settlement file containing participant-wise net obligations for both securities and funds legs to RBI where settlement takes place by simultaneous transfer of securities and funds through the SGL and current accounts under the 'Delivery versus Payment System-III (DvP-III)' mode. During the settlement process, if any participant fails to provide securities/funds, the same have to be provided by CCIL to the counterparty. CCIL collects margins from all participants and maintains 'Settlement Guarantee Fund' for this purpose.

All outright secondary market G-Sec trades are settled on a T+1 basis while the first leg in case of repo transactions can be settled on T+0 or T+1 basis. FPIs have been given the option for settling their OTC G-Sec transactions in either on T+1 or on T+2 basis.

9.6.1 Qualified Central Counterparty (QCCP)

The Basel Committee on Banking Supervision (BCBS) introduced the 'qualifying' central counterparty concept in July 2012. RBI designated CCIL as a Qualified Central Counterparty (QCCP) in January 2014 which implies that exposures of entities to CCIL will result in significantly lower capital requirements. As a QCCP, CCIL has to adhere to the Principles for Market Infrastructures (PFMIs) issued by the Committee on Payment and Settlement Systems and International Organization of Securities Commissions (CPSS-IOSCO) and publishes quantitative disclosures (annual and quarterly) related to its compliance. The PFMIs are the 24 international standards for central counterparties, securities settlement systems, payment systems, trade repositories and central securities depositories which have been issued to limit systemic risk and foster transparency and financial stability. In 2015, CCIL became one of the first global CCPs to be PFMI-compliant.

9.6.2 Default Handling Mechanism at CCIL

CCIL collects margins in the form of cash and liquid securities (G-Sec and T-Bills as notified by CCIL from time to time) in the Settlement Guarantee Fund (SGF) with cash being not less than 10% of the total margin requirement. Security shortages are met out of the SGF and/or Security Line of Credit Account (SLOC) and/or balances in its Proprietary SGL Account. In case of non-delivery of funds obligation by a participant, CCIL uses the Rupee Line of Credit available for the purpose and/or the balances in its RBI Current account. CCIL has also set up a Default Fund to meet losses arising out of any default by the participants.

Such a comprehensive framework helps CCIL to handle the various risks it faces. Credit risk is managed by multilateral netting and DvP-III settlement; Liquidity risk is reduced through settlement banks, lines of credit, bank guarantees etc. and Market risk is managed by using Value at Risk (VaR) based margining systems and continuous back-testing and stress testing to assess adequacy of resources.

9.7 G-sec Valuation in India

In earlier sections we have discussed about the pricing of various kinds of bonds. Regulators require investment portfolios to be regularly marked against market prices to address market risk. Fair valuation becomes critical for illiquid securities where no ready market prices are available, necessitating the availability of regulator approved benchmark prices. The regulations differ as per the nature of the G-sec investments. While 'Held to Maturity' (HTM) category investments can be carried at acquisition cost, other categories are marked to market at specified intervals (or more frequently): ‘Available for Sale’ (AFS) at year-ends and ‘Held for Trading’ (HFT) at monthly intervals.

In its February 07, 2018 statement on Developmental and Regulatory Policies, RBI directed the transfer of the benchmark administration activities relating to the valuation of Government of India Securities (G-Sec) and State Development Loans (SDL) from FIMMDA to Financial Benchmarks India Pvt. Ltd. (FBIL) with effect from March 31, 2018. FIMMDA remains the Calculation Agent, while the benchmark prices/yields are now published by FBIL at 7:00 PM daily.

G-Sec valuation is done using the cubic spline methodology where the curve generation is based on transaction level data pulled from the NDS-OM platform, with the primary input being actual traded prices/yields of “Nodal” securities (a security which is more representative with higher market activity), in absence of which observable and tradable price/yield information from the market or finally in absence of all these, proxy points are used. A nodal point is basically a representative G-Sec for each calendar year tenor (e.g. 2020, 2021, etc.). Chosen at the beginning of each month, these are the most traded G-Sec for each calendar year tenor (minimum 50 trades and ₹500 crore) in the previous month. A new methodology for valuing SDLs on basis of actual/observed market prices and

interpolation/extrapolation methods was notified by FBIL on March 26, 2019 and implemented from April 15, 2019.

Benchmarks pertaining to the G-Sec market published by FBIL are:

- FBIL Prices/YTM for G-Secs, including FRBs and IIBs
- FBIL Prices/YTM for SDLs
- FBIL Prices/YTM for Special Securities/Uday/Discom bonds
- FBIL Prices/YTM for STRIPS and ZCYC
- FBIL Par Yield Curve

G-Sec portfolios in India have to be valued as per these prices/yields. The detailed methodology is published on the FBIL website.

9.8 Key Regulatory Guidelines for the Indian G-Sec Market

The legal framework to the Indian G-Sec market is provided by RBI's "The Government Securities Act, 2006" and "The Government Securities Regulations, 2007" with amendments to these notified by RBI from time to time. CCIL is a payment system authorized by RBI under the Payment and Settlement Systems Act, 2007. Prudential norms for various investors are notified by their respective regulators.

Sample Questions:

1. Which agency is the Manager of Government Debt?
   (a) RBI
   (b) SEBI
   (c) FIMMDA
   (d) FEDAI

   Ans: (a)

2. '"When Issued Market" is used for _____.
   (a) Price fixation
   (b) Price allocation
   (c) Price discovery
   (d) Price settlement

   Ans: (c)

3. Which of the following entity invests in G-Sec market primarily for regulatory reasons?
   (a) Banks
   (b) Mutual Funds Investment
   (c) HNIs
   (d) Coporates

   Ans: (a)

4. Obligation under bilateral trades in G-Secs is settled at _____.
   (a) CCIL
   (b) RBI
   (c) NSDL
   (d) Directly among traders

   Ans: (a)

5. Multiple Price Auction means _____.
   (a) All participated bidders would get the allocation at the cut-off price
   (b) All participated bidders would get the allocation at their respective bid price
   (c) All successful bidders would get the allocation at the cut-off price
   (d) All successful bidders would get the allocation at their respective bid price

   Ans: (d)

CHAPTER 10: CORPORATE DEBT MARKET

LEARNING OBJECTIVES:

After studying this chapter, you should know about:

- Indian Corporate Debt Market
- Types of Instruments in Corporate Debt Market
- Trends in Indian Corporate Debt Market
- Issuance Mechanism
- Secondary Market Mechanism
- Key Regulatory Guidelines for Corporate Debt Market
- Corporate Bond Valuation

10.1 The Indian Corporate Debt Market

Corporate debt is the debt issued by non-Government issuers. Corporates issue good amount of debt to fund their operations. Corporates issue large number of instruments and varied types of instruments to meet their diverse funding needs and as per the demand for different types of debt instruments from the investors. Government typically reissue a paper by reopening the same to increase its floating stock as it is not worried about its repayment. However, non-Government entities are always worried about bunching of issues and large liabilities coming up for repayment at one go.

Typically, Corporates issue short term debt upto 1-year to fund their working capital requirement after incorporating Bank funding in their capital requirements and issue long term bonds to fund their long term needs to create various medium and long term assets and production infrastructure. Globally, Bank funding is the biggest source of capital for corporates. Over the years, financial markets get strengthened with safer rules and regulation, and efficient bankruptcy codes, etc. to attract domestic and foreign investment into the market.

The major investors in Corporate debt are largely institutional investors like Banks, Financial Institutions, Mutual Funds, Insurance Companies, etc. These investors are more guided by the prudential investment guidelines issued by their respective regulators. Demand for higher quality papers (with a Rating of 'A' and above) is generally very high.

Despite these inherent constraints, the Indian corporate debt market has witnessed significant growth in recent years due to the regulators' focus on enhanced transparency, expanded issuer and investor base as well as availability of better market infrastructure.

Key Players in the Corporate Bond Ecosystem in India are as follows:

1. Issuer

The "Issuer" is the entity that issues the debt instrument to borrow money from the investors against a promise of paying back the principal on the maturity date along with the periodic promised interest. The issuer may issue the bond either using a private placement option or using public issue protocol of SEBI. If issued to public, then it must be listed in a stock exchange for liquidity purpose. Privately placed debt may or may not be listed in a stock exchange.

Typically, issuers are Corporates, Banks, NBFCs, etc. who have substantial requirement of funds to run their operations. They issue short term instruments like Commercial Papers, Certificates of Deposits and long term instruments like Bonds, Debentures, etc.

2. Debenture Trustee

In India, the terms 'debenture' and 'corporate bond' are used interchangeably and both are identified as the same in the Companies Act. Like a bond, a debenture is also a debt instrument issued by a company to repay the borrowed sum at a specified date along with payment of interest. A Debenture Trustee (DT) is registered with SEBI and holds a piece of a secured asset like some parcel of property on behalf of the debt issuer and for the benefit of debenture holders who may not have legal access to the mortgaged property. Hence, Debenture Trustee is an entity which secures any issue of debentures by corporate entities for the benefit of debenture investors. Debenture Trustee plays a very important role in the Non-Convertible Debentures issue by safeguarding the interest of debenture holders and acting as an intermediary between the issuer company and the debenture holders. Scheduled commercial banks, insurance companies, public financial institutions or corporate bodies can act as Debenture Trustees.

DTs have the responsibility to protect the interest of the debenture holders as they have to ensure that the property charged is available and sufficient in value terms to discharge the interest and principal amounts during the life of the debenture. They call for periodic reports from the issuers and also ensure that the issuers comply with the provisions of the trust deed, the Companies Act and the listing agreements of the stock exchanges. DTs on noticing any breach of the trust deed or law have to act immediately to protect the interest of the debenture holders. In the event of default, DTs can appoint nominee directors on the issuer's board and also have the power and authority to sell the secured property to redeem the debentures.

The SEBI (Debenture Trustees) Regulations, 1993 govern DTs in India. As per the provisions of Companies Act, appointment of a DT is compulsory, if any debentures/bonds are issued with a maturity of more than 18 months. Unsecured debentures/bonds are treated as fixed deposits, if received from individual investors. In India, the issuer pays fees to the DT for its services.

3. Qualified Institutional Buyer (QIB)

Qualified Institutional Buyers are those institutional buyers and High Net-worth Individuals (HNIs) in the Indian market who are highly sophisticated and are generally allowed to invest in Private Placement market without much regulatory provisions when issuers look to raise capital through such private placement basis. These entities include:

a) Scheduled Commercial Banks
b) Insurance Companies registered with the Insurance Regulatory and Development Authority of India (IRDAI)
c) Mutual Funds
d) State Industrial Development Corporations
e) Multilateral and bilateral Development Financial Institutions
f) Provident Funds with minimum corpus of ₹25 crore
g) Pension Funds with minimum corpus of ₹25 crore
h) Public Financial Institutions as defined in the Companies Act
i) Foreign Portfolio Investors registered with SEBI
j) Venture Capital Funds registered with SEBI
k) Foreign Venture Capital Investors registered with SEBI
l) High Net-worth Individuals

4. Retail Individual Investors

"Retail Individual Investor" refers to investors who bid/apply for securities for ₹2 lakh or less. Mostly, retail investors are in the Tax-free bonds market. They invest in small quantities and at times hold debentures and bonds for diversification purpose.

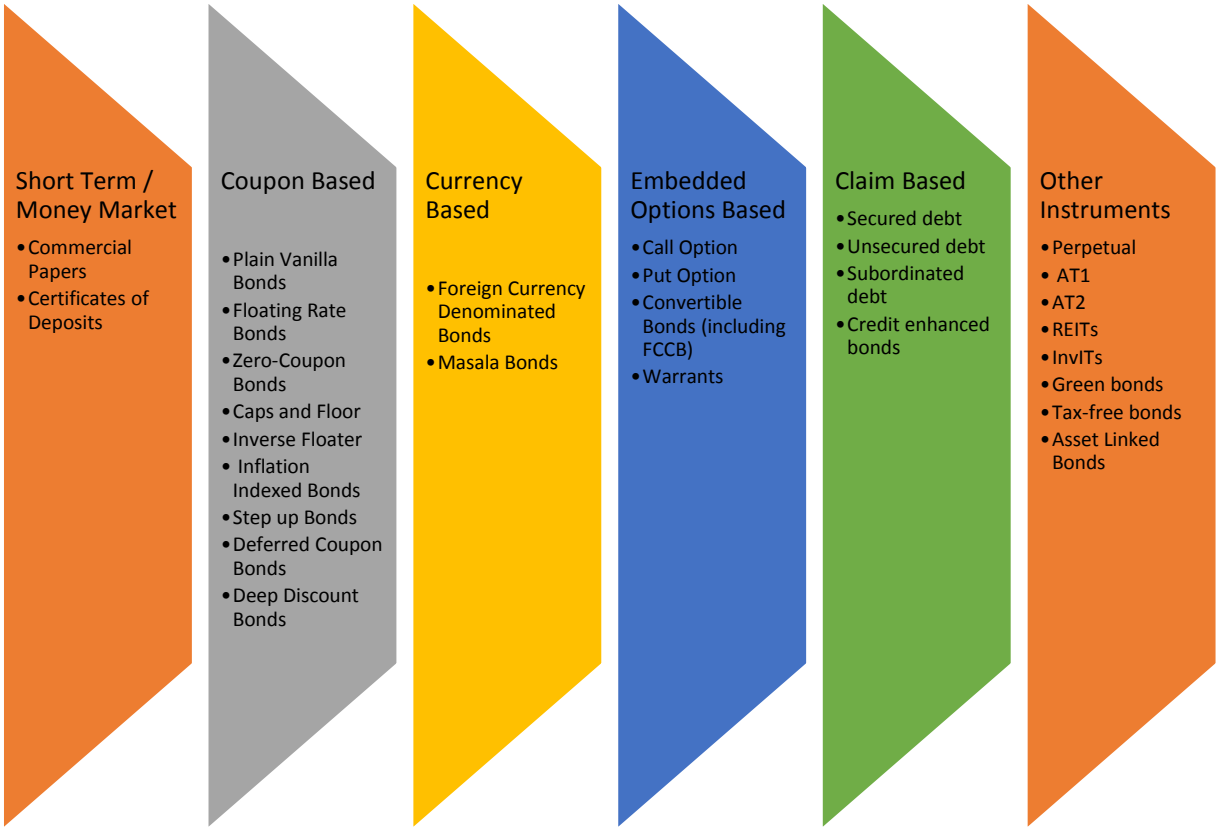
5. Designated stock exchange

"Designated stock exchange" means a stock exchange with nationwide trading terminals on which debt securities are listed and traded.

10.2 Types of Instruments in Corporate Debt Market

As we had discussed in Unit 2, the non-government or the corporate bond market encompasses a wide variety of instruments which are often customized as per the requirements of either the issuer or the investors. The basic classification of investments is revisited in the following diagram.

Chart 10.1:



- Short Term / Money Market Instruments
    - Commercial Papers: These are tradable short term instruments issued by the Corporates to raise working capital funds. These are typically issued by large corporates with higher rating and having a minimum prescribed net worth.
    - Certificates of Deposits: These are issued primarily by Banks to raise short term funding from the market. These instruments are rated for trading and issuance. Financial Institutions like SIDBI, NABARD, EXIM Bank, etc. can issue CDs of maturity upto 3 years.
- Coupon Based Instruments
    - Plain Vanilla Bonds: These are normal coupon bearing Bonds issued by non-Government entities to raise medium and long term resources.
    - Floating Rate Bonds are linked to an index and the coupon is reset mostly every half-year. The coupon is market driven.
    - Zero-Coupon Bonds: No coupon is paid out and it is redeemed at Par value at the end of the term of issuance.
    - Caps and Floor: An interest rate cap is a type of interest rate contract in which the buyer of the Cap contract receives payments at the end of each period in which the interest rate exceeds the agreed rate. Similarly, an interest rate floor is a contract in which the buyer receives payments at the end of each period in which the interest rate is below the agreed strike price.

    - Inverse Floater: An inverse floater is a bond or other type of debt whose coupon rate has an inverse relationship to a benchmark rate. An inverse floater adjusts its coupon payment as the interest rate changes. An inverse floater is also known as an inverse floating rate note or a reverse floater.
    - Inflation Indexed Bonds: These are either linked to Wholesale Price index or Consumer Price Index. These bonds protect investors from inflation.
    - Step up Bonds: In these instruments, earlier coupon paid is very low and slowly the same rises with time movement towards maturity of the bond.
    - Deferred Coupon Bonds: These bond do not pay any coupon at the beginning but the coupon is paid out at a later date.
    - Deep Discount Bonds: These bonds are sold at very high discount to their Face value and these are mostly long term instruments.
- Currency Based Instruments
    - Foreign Currency Denominated Bonds: These bonds are issuable and payable only in foreign currency and sold in a foreign market to foreign investors.
    - Masala Bonds: These are issued and payable in Indian Rupee and issued in a foreign market to foreign investors.
- Embedded Options Based Instruments
    - Callable Bonds: These bonds are having a call back option for the issuer if the refinancing cost drops and the issuer wants to refinance the obligations. These are generally known as Callable Bonds.
    - Puttable Bonds: These bonds are having a sell back option for the investor if the market interest rates rise and the investor wants to reinvest in higher paying securities with the same risk exposure. These are generally known as Puttable Bonds.
    - Convertible Bonds (including FCCB): A convertible bond is a debt security that makes interest payments, but can be converted into a predetermined number of equity shares of the issuing company. The conversion can be done at certain pre-fixed dates during the bond's life and is usually at the discretion of the bondholder. A foreign currency convertible bond (FCCB) is a type of convertible bond issued in a currency different than the issuer's domestic currency. In other words, the money being raised by the issuing company is in the form of foreign currency.
    - Warrants: These contracts give the right, but not the obligation, to buy or sell a security, most commonly equity, at a certain price before expiration. The price at which the underlying security can be bought or sold is referred to as the exercise price or strike price.
- Claim Based Instruments
    - Secured debt: Here the debt is secured by an asset (or a pool of assets) and the asset may have a claim over the general assets of the Company. In terms of liquidation, these entities are paid first.

- Unsecured debt: These are liabilities or debt issued by companies without any specific assignment of assets of the company. These debts will stand at the bottom in the list of the claimants in case of liquidation.
- Subordinated debt: These bonds have very low standing in the hierarchy of liquidation. These can be Junior subordinate and Senior Subordinate.
- Credit enhanced bonds: A company that is raising cash by issuing a bond may use credit enhancement to lower the interest rate it must pay to investors.

- Other Instruments
  - Perpetual: These bonds will not have any maturity date and will continue to pay coupons during the life of the Company.
  - AT1 Bonds: Additional Tier-1 bonds (AT1 bonds) are a type of unsecured, perpetual bonds that banks issue to shore up their core capital base to meet the Basel-III norms. These can be cancelled by the regulator without assigning any respite to the bond holder.
  - AT2 Bonds: Tier 2 bonds are components of tier 2 capital, primarily for banks. These are debt instruments like loans. As with all bonds and other debt instruments, they do not give ownership or voting rights, but they do offer interest earnings to bondholders or owners.
  - REITs: It is an investment fund on Real Estate Companies.
  - InvITs: Infrastructure investment trusts (abbreviated as InvITs) are investment instruments that work like mutual funds and are regulated by the Securities and Exchange Board of India. Their units are listed on different trading platforms like stock exchanges and are a wholesome combination of both equity and debt instruments. The primary objective of InvITs is to promote the infrastructure sector of India by encouraging more individuals to invest in it and can be modified according to a given situation. Typically, such a tool is designed to pool money from several investors to be invested in income-generating assets. The cash flow thus generated is distributed among investors as dividend income.
  - Green bonds: A green bond is a type of fixed-income instrument that is specifically earmarked to raise money for climate and environmental projects. These bonds are typically asset-linked and backed by the issuing entity's balance sheet, so they usually carry the same credit rating as their issuers' other debt obligations.
  - Tax-free bonds: These are targeted at retail investors who want to save Tax by investing in these instruments.
  - Asset Linked Bonds: These bonds are issued giving better credit enhancement to the investors. These are linked to some assets and the payable capability depends on the underlying asset’s ability to perform in the market.

10.3 Trends in Indian Corporate Debt Market

Following three features characterize the Indian corporate bond market:

1. Predominance of the financial sector: In India, manufacturing companies raise very little resources from the bond market while Finance Companies raise significant amount of resources from the market.
2. Predominance of the private placement market: Most issuance in the Market is private placement because it is cheaper than a public issue.
3. Very significant share of mutual funds and insurance companies as bond investors.

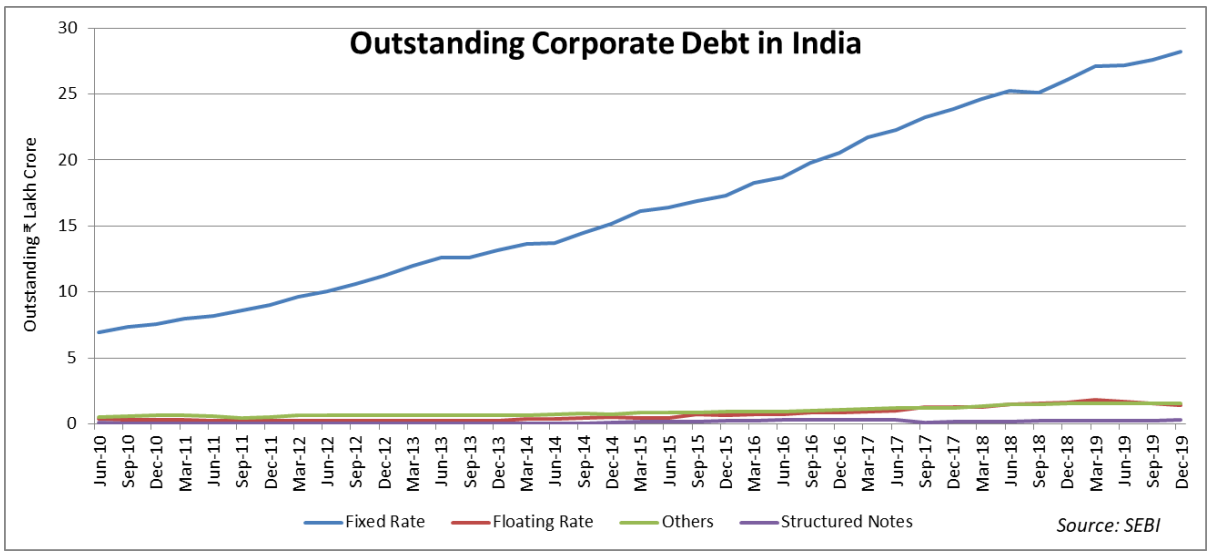
Table 10.1: Primary Issuance

(amount in Rs crores)

Year	Categories					
	Finance	Infrastructure	Manufacturing	Oil	Others	Total
2017-18	252217	207711	21996	2284	48847	533055
2018-19	234753	153080	14951	1164	38081	442029
2019-20	110633	96004	5585	433	21937	234593
Apr-20	11855	7802	2500	-	586	22742
May-20	12298	2546	3436	-	1115	19395
Jun-20	12440	12453	2725	-	3979	31597
Jul-20	17631	18524	2246	-	333	38735
Aug-20	11944	6100	675	-	1805	20524
Sep-20	21869	12289	7700	260	456	42573
2020-21 (Upto Sep 2020)	88037	59713	19282	260	8274	175566

Outstanding corporate debt has grown from about ₹8 lakh crore at end of June 2010 to ₹31 lakh crore at end of December 2019. This growth has however not been broad-based with the increase lead by issuances in fixed rate bonds only, which account for nearly 90% of total outstanding, indicating the reluctance towards complex products.

Chart 10.2:



Number of Instruments and Net Outstanding Amount (₹ Crore)										
	Fixed Rate		Floating Rate		Others		Structured Notes		Total	
Quarter Ended	Instruments	Amount	Instruments	Amount	Instruments	Amount	Instruments	Amount	Instruments	Amount
Jun-10	9028	696225.80	944	38325.76	903	53172.45	653	6298.20	11528	794022.20
Sep-10	9243	735433.10	950	31958.60	974	60866.96	680	5565.90	11847	833824.56
Dec-10	9264	759063.15	955	27575.54	996	61530.66	711	5344.12	11926	853513.47
Mar-11	9407	795418.83	1092	27292.48	927	61793.22	729	5005.31	12155	889509.84
Jun-11	9327	815157.50	1066	23815.81	1003	58170.61	817	5146.26	12213	902290.18
Sep-11	9564	862725.69	1134	23306.84	1073	47351.67	880	4953.36	12651	938337.56
Dec-11	9739	902887.01	1155	23010.65	1382	52763.31	900	4764.78	12448	983425.75
Mar-12	9989	964061.46	1118	20753.76	1736	62442.87	878	4380.61	13721	1051638.70
Jun-12	10262	1001492.56	1104	20443.14	1856	62688.88	876	4066.79	14098	1088691.37
Sep-12	10691	1062531.31	1137	22364.98	1910	62571.58	891	4067.69	14629	1151535.56
Dec-12	11240	1121210.14	1156	22784.14	1980	63786.95	881	3797.84	15257	1211579.06
Mar-13	11724	1197753.93	1184	23553.58	2068	64948.81	898	3890.61	15874	1290146.93
Jun-13	11941	1262240.71	1241	26122.89	1972	64193.51	910	3924.33	16064	1356481.44
Sep-13	11755	1263365.33	1212	25233.31	1892	64931.46	905	3981.92	15764	1357512.01
Dec-13	11859	1313276.19	1191	23783.58	1848	61563.11	895	4118.23	15793	1402741.11
Mar-14	10067	1362934.81	651	35441.97	1482	65170.58	904	3849.42	13104	1467396.78
Jun-14	12539	1369678.18	1446	38808.73	2077	68544.32	878	3646.66	16940	1480677.88
Sep-14	12893	1443395.04	1558	42605.23	2309	75981.16	918	5718.73	17678	1567700.16
Dec-14	13497	1515285.16	1674	51329.11	2511	73098.66	982	8742.69	18664	1648455.61
Mar-15	14090	1608885.63	1720	45647.84	2585	82364.62	1044	13422.33	19439	1750320.43
Jun-15	14549	1642206.76	1748	47541.82	2607	82875.21	1092	16297.47	19996	1788921.26
Sep-15	15249	1689992.03	1881	69963.36	2757	87119.43	1148	18984.90	21035	1866059.72
Dec-15	15476	1732674.72	1928	67400.68	2857	90231.51	1173	20918.84	21434	1911225.74
Mar-16	16166	1827248.97	2019	72404.04	2951	94053.67	1238	25589.24	22374	2019295.93
Jun-16	16691	1867953.59	2131	73171.67	2965	95003.88	1324	27184.94	23111	2063314.09
Sep-16	17201	1981380.72	2352	85083.15	2956	99490.57	1434	28739.77	23943	2194694.21
Dec-16	17354	2056211.55	2508	83896.26	2949	107065.18	1546	29822.88	24357	2276995.87
Mar-17	17832	2169238.82	2663	91237.97	3051	112964.22	1643	31469.64	25189	2404910.66
Jun-17	17928	2226850.50	2783	101585.87	3025	120650.18	1865	32165.28	25601	2481251.84
Sep-17	18127	2323942.78	2907	128540.00	2896	123018.97	1649	11355.57	25579	2586857.33
Dec-17	18241	2383233.14	2782	127840.35	2776	119055.13	1615	16905.61	25414	2647034.24
Mar-18	18052	2458776.70	2724	130230.08	2778	135844.75	1538	17407.53	25092	2742259.07
Jun-18	17798	2525749.19	2748	149713.06	2674	144487.14	1420	17733.71	24640	2837683.10
Sep-18	17407	2513183.81	2759	155719.47	2623	149234.53	1294	20073.53	24083	2838211.33
Dec-18	17419	2604951.00	2752	164665.00	2623	157358.00	1216	21191.00	24010	2948165.00
Mar-19	17541	2708367.21	2834	179756.72	2689	155997.94	1185	23106.31	24249	3067228.19
Jun-19	17469	2717512.89	2694	165846.58	2605	156969.77	963	23068.04	23731	3063397.28
Sep-19	17382	2755975.64	2642	154503.53	2519	154593.96	903	22725.70	23446	3087798.84
Dec-19	17520	2821163.35	2600	139707.80	3016	151982.06	874	31467.92	24010	3144306.31
Source: SEBI										

Issuances at the short-term spectrum of the corporate debt market have been declining in recent years. This is because of the issues in the Commercial papers after ILFS and DFHL fiasco. NBFCs which heavily depended on short term market to raise resources have not been able to garner enough funding through this route after the risk appetite dropped due to ILFS issues.

Table 10.2:

Outstanding (₹ Crore)

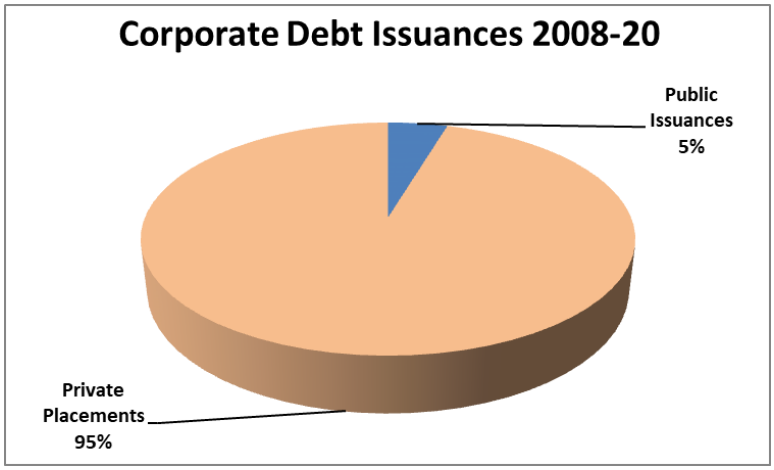
As at End-of-	Commercial Paper Issued by Companies	Certificates of Deposits Issued by Scheduled Commercial Banks
March-2011	80,305.00	4,44,525.00
March-2012	91,188.00	4,40,330.00
March-2013	1,09,255.00	3,93,120.00
March-2014	1,06,613.60	3,58,587.00

March-2015	1,93,268.00	3,29,096.00
March-2016	2,60,244.00	2,44,672.00
March-2017	3,97,965.25	1,55,741.25
March-2018	3,72,577.41	1,85,732.44
March-2019	4,83,084.45	2,72,260.35
March-2020	3,44,526.95	1,72,996.00
Source: RBI		

10.4 Issuance Mechanism

In India, corporate bonds are issued mainly on private placement basis (95%) and only a fraction of the total issuances are through public offer.

Chart 10.3:



A private placement is usually made to institutional investors. Private placement allows customized structure of the issue as per the requirements of issuers or investors.

Table 10.3:

Corporate Debt Issuances in India (₹ Crore)

Period	Public Issuances	Private Placements
FY09	1,500.00	1,73,281.18
FY10	2,500.00	2,12,634.92
FY11	9,451.17	2,18,785.41
FY12	35,610.71	2,61,282.65
FY13	16,982.05	3,61,462.00
FY14	42,382.97	2,76,054.18
FY15	9,713.43	4,04,136.50
FY16	33,811.92	4,58,073.48
FY17	29,547.15	6,40,715.51
FY18	4,953.05	5,99,147.08
FY19	36,679.36	6,10,317.61
FY20	14,984.02	6,74,702.88
Source: SEBI		

10.4.1 Public Issuance

"Public Issue" means an invitation by a company to public to subscribe to its debt securities offered through a prospectus. SEBI regulations require all public issues of debt to be listed on one or more recognized Stock Exchanges. SEBI (Issue and Listing of Debt Securities) Regulations, 2008 and amendments thereon govern public issue of debt securities. While the offer document for a public issue is not required to be approved by SEBI, an In-Principle approval is obtained from the stock exchange where it is to be listed. The offer document is prepared as per the disclosure requirements under the Companies Act, 2013 and SEBI Debt Regulations.

The Public Issue process begins with the appointment of a Merchant Banker. The issuer along with the Merchant Banker evaluates the objectives for the fund raising and structures the instrument which shall be most suited for the issuer based on balance sheet considerations, profitability and cash flow analysis. While structuring an issue, several factors are considered, including the type of redemption pattern of securities, options of interest payments based on redemption patterns and class of investors, the security to be offered and the timing of the issue among several other considerations.

The issuer then has to obtain credit rating for the issue from at least one credit rating agency (CRA) and disclose the same in the offer document. Issuers making a public issue or rights issue of debt securities also have to appoint one or more Debenture Trustees (DTs) in accordance with the provisions of the Companies Act. A trust deed has to be executed by the issuer in favor of the DTs before filing the offer document with the Registrar of Companies and the designated stock exchange. Once the In-principle Approval is obtained from the stock exchange, the issue is marketed to Financial Institutions, Institutional Investors, Mutual Funds, Insurance Companies, HNIs and Retail investors.

SEBI rules implemented from October 1, 2018 have cut the timeline for listing of debt securities to six days for all public issues of debt securities, NCRPS (Non-Convertible Redeemable Preference Shares) and SDI (Securitized Debt Instruments), while drastically simplifying the process and making it more cost effective. The ASBA (Application Supported by Blocked Amount) mandated for all the applicants in a public issue of debt securities has further reduced the time for public issues which can now be traded from the sixth day of the closing of the issue.

"Rights Issue" refers to an offer of new debt securities to the existing holders of the issuer's debt securities.

10.4.2 Private Placement

Private Placement refers to an offer of sale of debt securities by an issuer to a select group of people/institutions. All the necessary information about the issue is given in the Private

Placement Memorandum (PPM). SEBI issued required guidelines in September 2003 for public limited companies for privately placed debt issues. From 2004, the listing of all debt securities, whether privately placed or a public/rights issue, is done through a separate listing agreement. With the majority of corporate debt issuances in India being private placements, SEBI vide its circular of April 21, 2016 made issuance through electronic book mechanism (EBM) mandatory for private placements for better and transparent price discovery. SEBI further streamlined the procedure through its revised guidelines in force from April 1, 2018. The EBM guidelines are applicable for debt securities and non-convertible redeemable preference shares as defined under SEBI regulations and 'Commercial paper' and/or 'Certificate of Deposits' defined under RBI guidelines issued via private placement mechanism.

While EBM is mandatory for issues with an issue size of ₹200 crore and above, it can also be used for issues of less than ₹200 crore. As per SEBI regulations, all recognized stock exchanges can act as an Electronic Book Provider (EBP) and can provide online platforms for placing bids while ensuring safety, secrecy, integrity and retrievability of data. While the issuer is not required to file the offer document with SEBI, it has to obtain credit rating for the instrument from at least one CRA and file a self-disclosure document with the exchange where it seeks to list the security.

All participants are required to enroll with EBPs prior to entering into the bidding process. These include issuers, arrangers, QIBs, non-QIBs and custodians. Arrangers bid on the EBP platform on behalf of other eligible participants and include Merchant Bankers/brokers/RBI registered Primary Dealers. Custodians bid on behalf of their foreign portfolio investor (FPI) clients. All non-QIB participants including arrangers have to be authorized by the issuer to participate in a particular issue. Exchanges provide unique codes to each participant which can be used to participate in EBP platform. The minimum bid lot is ₹10 lakh and in multiples of ₹10 lakh thereafter. However, in case of Non-Banking Finance Company (NBFC) and Housing Finance Company (HFC), the minimum bid lot is ₹1 crore and in multiples of ₹10 lakh thereafter. In case of a reissuance, the issuer has to specify the ISIN of the existing security and the accrued interest as on the date of pay-in (banking date) for the reissued securities. For re-issuances, the bidding is done on clean price basis (as discussed in Unit 4). Necessary issue specific documentation includes the PPM/Information Memorandum (IM) and credit rating reports.

The PPM/IM has to mandatorily disclose the mode of bidding (open/close), manner of allotment (uniform/multiple yield), manner of settlement (through clearing corporation/escrow bank account of issuer) and settlement cycle (T+1 or T+2). In case of open bidding, the bid information, such as bid value and bid rate/price (except the bidder name), is available to the market during the bidding window. However, in case of closed bidding, the same is disclosed post bidding. Only the cumulative bids amount (in Rs crores)

is displayed to the eligible participants during the bidding period. The issuer has to disclose the estimated cut off yield to the EBP at least one hour prior to opening of the bidding for the issue. Successful bids are determined by the EBP on yield-time priority basis and post successful closure, shared with the designated Registrar to the Issue. It also electronically notifies all the successful bidders about the total payable amount in INR, details of the pay-in account where the amount is to be deposited and the pay-in date and cut-off time. Once the bidding window closes, the EBP gives out the aggregate volume data that includes yield/coupon/price, amount with oversubscription, total bids received, ratings, category of Investor (anonymous basis), etc.

10.5 Secondary Market Mechanism

Unlike the G-Sec segment with dominant electronic trading and easy availability of trade information, corporate debt trading in India is mainly OTC, although regulatory measures to improve dissemination of trade information has led to improved transparency on market activity and levels. Stock Exchanges also provide trading in G-Sec but the settlement through Demat account was not very smooth and hence the trading has not really pick up in those Exchanges.

10.5.1 Trading Mechanism

Trading in the Indian corporate bond market is generally done OTC through brokers and reported on the exchange reporting platforms. SEBI permitted stock exchanges with nationwide trading terminals to launch order driven trade matching platforms vide its circular of April 13, 2007. The lot size for trading in bonds has been reduced to ₹1 lakh to encourage trading.

10.5.2 Reporting Mechanism

As per regulations, all OTC trades in corporate bonds have to be reported within 15 minutes of deal closure on the reporting platforms of stock exchanges which is then consolidated and disseminated on the FIMMDA website. SEBI also disseminates the same on its website. The Financial Market Trade Reporting and Confirmation Platform (F-TRAC) operated by CCIL is the Trade Repository or database for secondary market outright transactions in CDs, CPs, and repo transactions in Corporate Bond/CD/CP/ NCDs of original maturity of less than one year. CD primary market reporting also commenced on F-TRAC on June 3, 2019.

Either the buyer or the seller can report the trade on the platform of their choice, but the reporting party has to enter both sides of the deal. Acknowledgment emails are sent to the buyer as well as the seller for each trade that is reported. The reporting platform captures the IP address from which the trade is being reported to ensure the authenticity of trades being reported. Information to be entered captures details of buyer, seller and the trade. The parties have to confirm the trade on the platform after receipt of confirmation emails.

10.5.3 Clearing & Settlement

Settlement risk is a major impediment to secondary market activity in corporate bonds. In the absence of a CCP (like CCIL in the case of the G-sec market), corporate bond trades are settled on a DVP-I basis (without settlement guarantee) at participant level through the clearing corporations of stock exchanges.

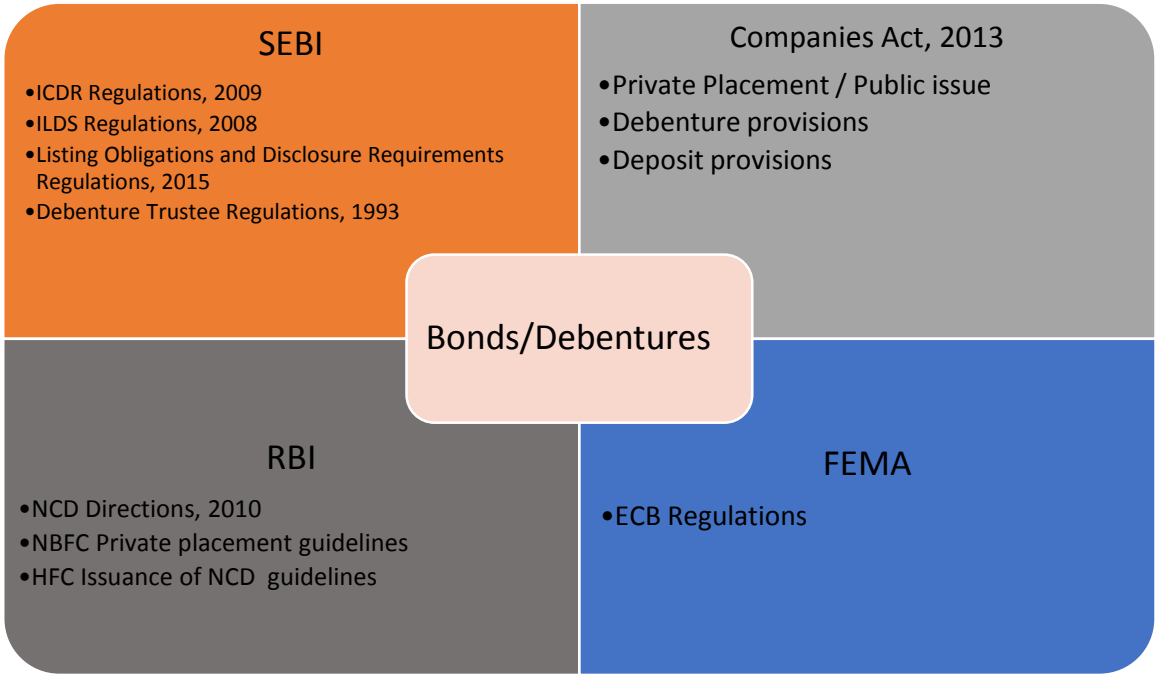
10.6 Key Regulatory Guidelines for Corporate Debt Market

The multitude of regulations to be adhered to is one of the impediments to the expansion of the corporate debt market in India. The regulatory framework on issuances requires adherence to multiple regulators.

From Issuer's Perspective:

The basic norms for private placements by a financial entity have been made stringent as the investors in bonds have to be pre-identified and the money raised by subscription cannot be used until return of allotment has been filed. Issue of short-term debentures, up to a duration of 12 months, is subject to specific directions in terms of Section 45W of the RBI Act, 1934. As bonds are mostly secured, there are rules about security creation, both under the Companies Act, 2013 and under SEBI Issue and Listing of Debt Securities (ILDS) Regulations. ILDS Regulations require trustees in case of every listed issue. Foreign issues are subject to FEMA guidelines.

Chart 10.4:



From Investor's Perspective:

The regulatory framework for investors is guided by the norms laid by the respective regulators which often apply to investments in general and are not specifically targeted at debt investments. For example:

- Banks' investments in bonds are heavily regulated by RBI and more often may be cases of a credit substitution rather than pure investments. The Banks at times hit the ceiling in lending to an entity and indirectly and discretely take exposure to the entity through private placement of the debt of the entity.
- NBFCs' investment guidelines are generic and not debt-specific.
- Several norms have been laid down by RBI and SEBI for FPIs.
- SEBI norms guide debt investments by mutual funds.
- Investments by provident funds and pension funds are heavily regulated with specific guidelines by PFRDA and Government as they have to protect the nest egg of millions of workers/employees.
- While there have been substantial investment by insurance companies, these are mainly focused towards AT 1 and AAA corporate paper.
- Trusts can make investments as per the relevant trust deed or the provisions of the Trust Act in case the trust deed does not specify the modes of investment.
- Investments by Foreign Venture Capital Investors are guided by the FVCI Regulations.
- Alternative Investment Funds (AIFs) have general and specific investment conditions laid down in the AIF Regulations.

10.7 Corporate Bond Valuation

Corporate debt instruments in India are valued as per methodology notified by FIMMDA from time to time. These are comprehensive guidelines that specify valuation norms for bonds based on their various classifications as discussed earlier, e.g. payment features, embedded options, maturity structure, credit rating, etc. as well as incorporate regulatory requirements (such as the RBI guidelines for Valuation of Non-SLR Bonds, etc.). The methodology documents are available on the FIMMDA website for detailed study.

Sample Questions:

1. Good Private Corporates may issue _____ for meeting their short term requirements.
   (a) Certificate of Deposits
   (b) Commercial Papers
   (c) Bonds
   (d) Debentures

   Ans: (b)

2. Green Bonds are _____.
   (a) Bonds raised for deforestation
   (b) Bonds raised for creating awareness of fire safety
   (c) To raise money for climate and environmental projects
   (d) To raise money for social causes under Corporate Social Responsibility (CSR) scheme of the Government

   Ans: (c)

3. Corporate bond valuation methodology is notified by _____.
   (a) FIMMDA
   (b) FEDAI
   (c) CCIL
   (d) RBI

   Ans: (a)

4. Short term debt is issued by private corporates through _____.
   (a) Commercial Papers
   (b) Certificate of Deposits
   (c) Coupon bearing papers
   (d) Debentures

   Ans: (a)

5. Deep Discount Bonds are _____.
   (a) Sold at very high discount to their face value
   (b) Sold at very high premium to their face value
   (c) Sold at very low discount to their face value
   (d) Sold at very low premium to their face value

   Ans: (a)

About NISM

National Institute of Securities Markets (NISM) is an educational institution established by the Securities and Exchange Board of India (SEBI), the securities market regulator, in 2006. The Institute was established in pursuant to the Union Finance Minister's proposal, in his 2005-06 Budget Speech, to set up an institution 'for teaching and training intermediaries in the securities markets and promoting research'.

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About the Workbook

This workbook has been developed to assist candidates in preparing for the National Institute of Securities Markets (NISM) Certification Examination for Fixed Income Securities. NISM-Series-XXII: Fixed Income Securities Certification Examination seeks to enhance the knowledge and proficiency in the Fixed Income Securities markets in India.

This book covers many important aspects of Fixed Income Securities Markets in India including the basics of Indian debt markets, types of fixed income securities, pricing of bonds, yield measures, term structure of interest rates and the risks associated with investing in Fixed Income Securities. This book also covers the Money Market, Government Debt Market and Corporate Debt Market in India.

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