

## Term Structure Interest Rate Theories

### \* Expectations Hypothesis

- To determine the long term interest rate given the short term interest rate in a particular period.
- The expectations of interest rate of the market participants decide the yield curve.
- ~~they~~ Long-term interest rate represents the geometric mean of current and future one-year interest rates expected to prevail over the maturity.

$$1 + t_R P = \sqrt[N]{(1 + t_1 R_1)(1 + t_2 R_2) \cdots (1 + t_n R_n)}$$

$$(1 + t_R n) = [(1 + t_1 R_1)(1 + t_2 R_2) \cdots (1 + t_n R_n)]^{1/N}$$

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$R_n \rightarrow$  Actual long-term rate

$N \rightarrow$  Term to maturity in years

$t_1 R_1 \rightarrow$  Current 1 year rate.

$t+i R_1 \rightarrow$  Expected 1 year rate during the future period  $t+i$  (forward rate)

$$1 + t+n g_{1,t} = (1 + t R_{1,t}) (1 + t+1 g_{1,t}) (1 + t+2 g_{1,t}) \cdots (1 + t+n g_{1,t})$$

$$(1 + t R_{1,t}) (1 + t+1 g_{1,t}) (1 + t+2 g_{1,t}) \cdots (1 + t+n-1 g_{1,t})$$

$$t+n g_{1,t} = \frac{(1 + t R_{n+1})^{n+1}}{(1 + t R_n)^n} - 1$$

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Example: Five year spot rate = 10%  
 Four year spot rate = 9%

Forward one-year rate four years from now implied by these spot rates.

$$t R_5 = 10\%$$

$$t R_4 = 9\%$$

$$t+n g_{1,t} = \frac{(1 + t R_5)^5}{(1 + t R_4)^4} - 1 = \frac{(1 + 0.1)^5}{(1 + 0.09)^4} - 1$$

$$= \frac{1.6105}{1.4116} - 1 = 14.09\%$$

$\Rightarrow 14.09\% \rightarrow$  Interest rate that will prevail 4 years from now, i.e. in the 5th year.

$$\boxed{t+n g_{1,t+j} = \frac{(1 + t R_{n+j})^{n+j}}{(1 + t R_n)^n} - 1}$$

$t+n$   $r_jt \rightarrow$  forward  $j$  year rate  $n$  years from now.

- If short-term rates are expected to rise in the future, then there is a rising yield curve. If short-term rates are expected to fall in the future, then the long-term rates will lie below the current short-term rates; there will be a falling yield curve.
- Assumptions: Perfect competition, Rational market participants, 0 transaction cost, Investors have perfect foresight (perfect future expectations), all the products are substitutes to each other.
- Drawbacks: It does not consider the risks involved in investing in a long-term security as compared to a short-term security. It does not consider the price volatility, interest rate volatility, etc. (And long-term bond's price is more interest rate sensitive compared to a short-term bond). And therefore prices of long-term bonds are more volatile & thus more risky & therefore certain premium is given to the investor.

## ★ Liquidity Preference Theory (Risk - Premium Theory)

- There is a risk-premium or liquidity-premium in a long term bond over and above a short term bond.
- Uncertainty and volatility makes an investor reluctant to invest in a long-term bond, some premium should be given to the investor to invest in the long-term bond.
- Risk-premium ~~same~~ cancels the added volatility of a long-term bond compared to a short-term bond.

$$(1+{}_t R_n) = [(1+{}_t R_1)(1+{}_t + {}_1 \gamma_1 + L_1) \cdots (1+{}_t + {}_N \gamma_1 + L_n)]^{1/N}$$

- $L_2, L_3, \dots, L_n \rightarrow$  Risk-premiums and these are not same in different periods and these are expected to increase with maturity. because price volatility of a bond increases with maturity.
- It highlights the preference for liquidity and the desire to minimize the income risk, capital risk as additional factors which determines the term structure interest rates.
- Investors will hold long-term bonds if they offer higher yields than the expected future interest rates, with the risk-premium.

increasing with the term to maturity.

- The yield curve will be governed by the expected spot rate which is the sum of the forward rate & the liquidity premium.

## \* Market Segmentation Theory

- Yield curve is determined by the supply & demand conditions which are unique to a particular market segment.
- <sup>theory</sup> This assumes that markets are segmented on the basis of maturity i.e. short-term and long-term market.
- And the investors investing in the two markets are also different in their preferences and expectations. The interest rate prevailing in those markets is also different based on the supply & demand in the 2 markets.
- Expectations theory tells that long-term & short-term bonds are substitutable. But this theory says that short-term securities are substitutable among themselves and long-term securities can be substituted among themselves but short-term & long-term securities cannot be substituted with each other.

Also, the factors affecting the two market segments are also different.

- E.g. short-term corporate bonds; they depend upon the business demand for the short-term assets, current assets, inventories, etc. Demand for the short-term bonds by the investors & the supply of such bonds by the companies determine their interest rates.
- Long-term bonds depends upon if the company wants to go for plant expansion, fixed assets, acquisitions, etc. Demand comes from different investors. e.g. pension funds, mutual funds etc who invest money for long-term.
- ∵ The investors as well as suppliers of these bonds are different because the objective of these stakeholders may not be same.
- The different market segments: short term, long term, intermediate term are independent of each other.
- ∵ The yield curve will depend on the factors which determine the demand and supply of the different types of bonds i.e. the macroeconomic factors like GDP, growth rate, Inflation, etc.

## \* Preferred Habitat Theory

- Assumption: The investors and borrowers are willing to give up their desired maturity segment if the rates are attractive.
- The investors and borrowers will be induced to forgo their perfect hedges and shift out their preferred maturity segments when the supply and demand forces in the different market segments do not match.
- i.e. Investors may switch their market segments if the interest rates in that other segment is more lucrative even if their horizon period ~~is~~ is not matching with that segment.
- Let there is an economy where more investors want to invest in short-term but more borrowers want to borrow long-term. ∵ the market will not be in equilibrium.
- ∵ There is excess ~~of~~ supply in the long-term market which will force the issuer to lower the bond prices. ∴ Interest rate will go up which will induce the investors to change their short-term demands. ~~and~~ And in the short-term market, excess demand will cause bond prices to rise & interest rate will fall. ∵ it will induce some corporations

to sell their short-term assets to finance their long-term assets.

- Ultimately, equilibrium in both markets will be reached with long-term rates higher than the short-term rates, due to the risk-premium in long-term.
- If there is some distortion in any market, then some shift will occur from one segment to other & vice-versa and equilibrium in all segments will be restored.
- Yield curve will be rising.

If interest rate is about to decline in the market, then there is a need to run to the ~~stop~~ water whatever needed.

- If the interest rate is going to decline, then the bond price will rise in future, investors want the bond to be more interest rate sensitive so that they can enjoy the price rise. Long-term bonds with low ~~coupons~~ coupons are more interest rate sensitive. Investors will prefer long-term bonds with low ~~maturity~~ coupons.
- Instead, if the interest rate is expected to rise, then short-term bonds with high coupons are considered. This will reduce the price volatility.
- Price volatility or interest rate sensitivity varies directly with <sup>term to</sup> maturity & inversely with coupon rate.
- It is necessary to determine the best combination of these 2 variables (coupons & term to maturity) to achieve the objective.  
∴ We generally consider a composite measure of the interest rate sensitivity of a bond.

### \* Duration (Macaulay Duration)

- It shows that duration of the bond is a more appropriate measure of the time characteristic, than the term <sup>the</sup> to maturity.
- Because the duration considers both, the

repayment of capital at maturity and the size & time of coupon payments till maturity.

- Weighted average of bond's time periods. Weights are given on the basis of the time relative to the present value of that particular cash flow in that particular time.

$$D = \sum_{t=1}^n \frac{C_t(t) \times w_t}{(1+i)^t}$$

$$\sum_{t=1}^n \frac{C_t}{(1+i)^t}$$

↓  
Price of the bond

$$D = \sum_{t=1}^n \frac{t \cdot PV(CF_t)}{P_0}$$

E.g. Bond A

Face value: 1000

Maturity: 10 yrs

Coupon: 4%

Bond B.

1000

Yield to maturity

= 8%

Year

1

2

3

4

5

6

Year

7

8

9

10

(1)	(2)	(3)	(4)	PV(5)
Year	Cashflow.	PV at 8%	PV of Cashflow	% price (1)X(5)
1	40	0.9259	37.036	0.0506
2	40	0.8573	34.293	0.0468
3	40	0.7938	31.752	0.0434
4	40	0.7350	29.400	0.0402
5	40	0.6806	27.223	0.037
6	40	0.6302	25.206	0.0344
7	40	0.5835	23.339	0.0319
8	40	0.5403	21.610	0.0295
9	40	0.5002	20.001	0.0273
10	1040	0.4632	<del>18.5</del> 731.588	0.6585 1 8.1193

Bond A: Duration = 8.12 years

Bond B: Duration = 7.25 years.

- 1) ~~Mark~~ Macaulay duration with the coupon payments is always less than the term to maturity.  
 $D < T$
- 2) Inverse relationship b/w coupon and duration.  
 $4\% \text{ coupon} \rightarrow D = 8.12$        $C \propto \frac{1}{D}$   
 $8\% \text{ coupon} \rightarrow D = 7.25$ 

Higher is the coupon, lesser the duration.
- 3) Duration of a ~~is~~ zero-coupon bond is the term to maturity.  
 $D = T$
- 4) ~~Time~~ Duration is directly proportional to the term to maturity.  
 $D \propto T$
- 5) Duration increases at a decreasing rate with the term to maturity.

i.e. the rate of increase of duration is always less than the rate of increase in term to maturity.

- (a) Duration is inversely proportional to the yield to maturity or market interest rate.  

$$D \propto \frac{1}{YTM}$$
- (b) Duration also gets affected by any kind of features that may be embedded with the particular bond like call or put feature.

### \* Modified Duration

- It is used to approximate the interest rate sensitivity of a bond.

$$D_{\text{modified}} = \frac{D_{\text{Macaulay}} \cdot \text{Duration}}{1 + \frac{\text{YTM}}{\text{frequency of coupon payments}}}$$

E.g. YTM = 8%, Coupon paid semi-annually.

$$D_{\text{Ma}} = 10$$

$$D_m = \frac{10}{(1 + \frac{0.08}{2})} = \frac{10}{1.04} = 9.62$$

- The price movements will change proportionally with the modified duration for a small change in the yield.

$$\frac{\Delta P}{P} \times 100 = - D_{\text{Mod}} \times \Delta i$$

$\Delta P \rightarrow$  Change in price.

$D_{\text{Mod}} \rightarrow$  Modified duration

'-' sign is there because there is an inverse relationship b/w yield & price change.

$\Delta i \rightarrow$  Change in the yield / interest rate

e.g.  $D = 8$  years       $D_{\text{Mod}} = 8.0$  years  
 $i = 10\%$                   ~~Interest~~

~~Market Macaulay~~ Assume interest rate 0.75

Modified duration =  $\frac{8}{1.05} = 7.62$

$\Delta i = 0.75\%$

% change in bond price:  $\frac{\Delta P}{P} \times 100 = - 7.62 \times 0.75$

$$= - 7.62 \times -0.75$$

$$= 5.72$$

$\therefore$  Bond price will increase by 5.72% in response to 0.75% decline in the interest rate.

Price of bond:  $900 \rightarrow 900 + (900 \times 0.0572) = 951.48$

- If interest rate is expected to decline, average modified duration should be increased to experience high price volatility.

- If interest rate is expected to rise, the average modified duration should be decreased to reduce the price fall.
- Duration of a portfolio:

$$D_p = \sum_{i=1}^n w_i D_i$$

$w_i \rightarrow$  Proportion of fund invested in asset i.

$$\text{Duration} = \frac{dP/P_0}{dy} = \frac{1}{1+y} \left( \sum_{t=1}^n t \frac{PV(CF_t)}{P_0} \right)$$

$y \rightarrow$  yield

$P_0 \rightarrow$  price

$$P_0^B = \frac{C}{y} \left[ 1 - \left( \frac{1}{1+y} \right)^n \right] + \frac{F}{(1+y)^n}$$

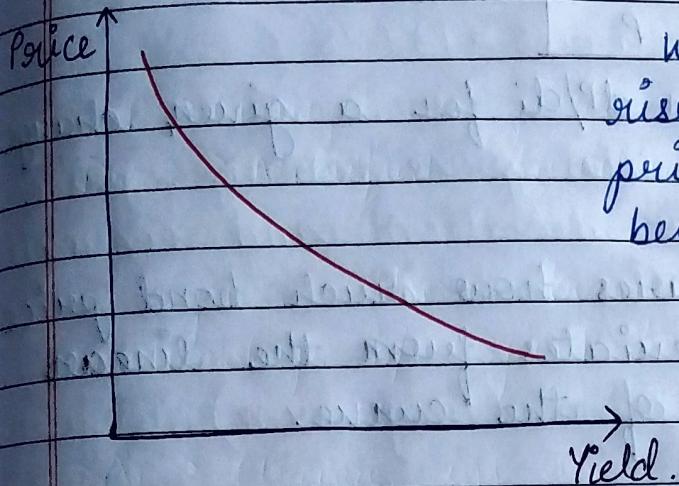
Differentiating wrt y

$$\frac{\partial P_0^B}{\partial y} = \frac{-C}{y^2} \left[ 1 - \left( \frac{1}{1+y} \right)^n \right] + \frac{C}{y} \left[ \frac{1}{(1+y)^{n+1}} \right] + \frac{N(F-C/y)}{(1+y)^{n+1}}$$

Modified duration =

$$\frac{-\frac{C}{y^2} \left[ 1 - \frac{1}{(1+y)^n} \right] + \frac{n(F-C/y)}{(1+y)^{n+1}}}{P_0^B}$$

## \* Convexity



When interest rate rises, rate at which price of the bond declines becomes slower.

- When yield declines, rate at which price grows becomes faster.
- ∵ If the convexity is greater, then the price performance of the bond next ~~yield~~ yield will be better.
- If there are some bonds with equal duration but different convexities, then the bond with greater convexity should be considered to get higher price performance.
- Convexity measures the rate of change of slope of the price yield curve.
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$$D_{mod} = \frac{dP}{di} \rightarrow \text{slope}$$

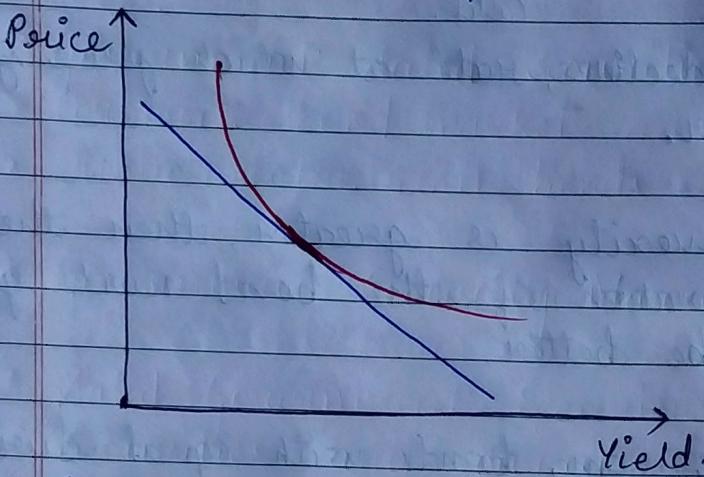
P

Convexity = Rate of change of slope

$$\text{Convexity} = \frac{\left( \frac{d^2P}{d^2i} \right)}{P}$$

= % change in  $dP/di$  for a given change in yield.

- Convexity measures how much bond price yield curve deviates from the linear approximation of the curve.



- If a bond has no extra features like callable or putable, then convexity is a +ve number i.e. the curve is always above the linear approximation line.
- Inverse relationship b/w coupon percentage and convexity.
- Direct relationship b/w term to maturity and convexity.
- Inverse relationship b/w the yield to maturity and convexity.

- i.e. price-yield curve is more convex at lower yields & less convex at higher yields.

E.g. Maturity = 3 years.

Coupon = 12%

YTM = 9%

F = 1000

$$\frac{d^2P}{di^2} = \frac{1}{(1+i)^2} \left[ \sum_{t=1}^T (t^2 + t) \frac{CF}{(1+i)^t} \right]$$

$$\frac{d^2P}{di^2} \text{Convexity} = \frac{1}{1.09^2} \cdot 2 \cdot 120 + \frac{1}{1.09} \cdot 6 \cdot 120 + \frac{12}{1.09^2} \cdot 1120$$

$$= 185.324 + 510.066 + 8735.078$$

$$= 9430.468$$

$$P = \frac{120}{1.09} + \frac{120}{1.09^2} + \frac{1120}{1.09^3} = 1075.939$$

$$\text{Convexity} = \frac{9430.468}{1075.939} = 8.765$$

Price change due to convexity

$$= \frac{1}{2} \times \text{Price} \times \text{Convexity} \times (\Delta i)^2$$

E.g. MP = 18 years, Coupon = 12%, YTM = 9%,

Price of bond = 126.5, Dmod = 8.38

Convexity = 107.7, Change in interest rate  
= -100 basis points = -1%.

Price change =  $-8.38 \times \frac{-100}{100} = 8.38\%$

$$8.38 \times 126.5 = 10.6$$

100

$$\frac{1}{2} \times 126.5 \times 107.7 \times (0.01)^2 = 0.68$$

$$126.5 + 10.6 + 0.68 = 137.78$$

$\therefore$  To find the total price change, price changes due to duration and convexity are algebraically added.

### \* Bond Markets in India (Long term)

- Government dated securities market
- Corporate bond market
- Public sector unit bonds

### \* Government Security Market

- Dated Government Securities are longer term securities and carry a fixed or floating coupon (interest rate) paid on the face value, payable at fixed time periods (usually half-yearly).
- The tenor of dated securities can be up to 30 years.
- The Public Debt Office (PDO) of the RBI acts as the registry/depository of Government securities and deals with the issue, interest payment and repayment of principal at maturity.

## \* Importance of Government Securities Market

- It sets a benchmark for the rest of the market because these are risk-free investments.
  - acts as the benchmark for pricing corporate securities of varying maturities.
  - Essential for the conduct and effectiveness of Open Market Operations (OMOs).
  - Free of default risk or credit risk as it is backed by the government.
  - GSM facilitates public borrowings at reasonable cost and the avoidance of automatic monetisation of government deficit.
  - GSM provides flexibility to the authorities in their ~~task~~ task of debt management.
  - Plays a crucial role in the monetary policy transmission mechanism.
- ## \* Existing ~~of~~ structure and organization of ~~L~~ated GSM in India
- Major players in the Government securities market include Reserve Bank of India, commercial ~~banks~~ banks and primary dealers

besides institutional investors like insurance companies.

- Foreign Institutional Investors (FIIs) are allowed to participate in the Government Securities Market within the quantitative limits prescribed from time to time. Corporates also buy/sell the government securities to manage their overall portfolio risk.
- The investors in this market can be classified into different segments such as
  - Wholesale market which comprises the players like banks, financial institutions, insurance companies, primary dealers and mutual funds.
  - Middle segment comprising corporate, provident funds, non banking financial companies and co-operative banks.
  - Retail segment consisting of individuals and non-institutional investors.
- The holders can maintain their securities in dematerialised form in either of the two ways:
  - SGL account: Reserve Bank of India offers

- Subsidiary General Ledger account (SGL) facility to select ~~entities~~ entities who can maintain their securities in SGL accounts maintained with the Public Debt Offices, of the Reserve Bank of India.
- Gilt account: As the eligibility ~~is~~ to open and maintain an SGL account with the RBI is restricted, an investor has the option of opening a Gilt account with a bank or a Primary Dealer which is ~~is~~ eligible to open a Constituent's Subsidiary General Ledger account (CSGL) with the RBI.

### Trading of Sated Government Securities in Secondary Market.

- Over the Counter (OTC) / Telephone Market Transactions undertaken between market participants in the OTC / telephone market are expected to be reported on the NDS platform within 15 minutes after the deal is put through over telephone.
- Negotiated Dealing system  
The Negotiated Dealing System (NDS) for electronic dealing and reporting of transactions in government securities was introduced in February 2002. It facilitates the members to submit electronically, bids for applications for primary issuance of Government Securities

when auctions are conducted.

- Stock exchanges

Introduced for retail investors through the stock exchanges like NSE and BSE.

→ Difference b/w Treasury bills and Dated Govt. Securities: Treasury bills are issued for short-term whereas dated Govt. securities are issued for long-term. Other characteristics ~~are~~ are same.

### \* Corporate Bond Market.

- Corporate debt is a security issued by a corporation and sold to investors.
- Corporate bonds are considered riskier than the Govt. securities. ∵ rate of return for corporate bonds is also generally higher than that of Govt. securities.
- The backing for the bond is usually the payment ability of the company, which is typically money to be earned from future operations. In some cases, the company's physical assets may be ~~bonds~~, ~~not a security~~, ~~inter~~ used as ~~for~~ collateral for bonds.
- Corporate bonds are considered higher risk than government bonds. As a result, interest

rates are almost always higher.

- Bonds which are backed by some collateral, are secured bonds.
- Bonds which do not have any collateral as back-up are called unsecured bonds.

### \* Classification of Corporate Bonds in India

#### • Based on issuer

→ Issued by corporates

→ Issued by banks

→ Issued by public sector undertakings

→ Issued by local bodies

#### • Based on maturity

→ Short-term: Maturity period less than 1 year.

→ Medium term: Maturity period between 1 and 5 years.

→ Long term: Maturity period more than 5 years.

→ Perpetual: No maturity

- Based on coupon

- Zero coupon bonds: No coupons are paid. The bond is issued at a discount to its face value, at which it will be redeemed.
- Fixed coupon: Coupon rate that remains constant throughout the life of the bond.
- Floating coupon: Coupon rates are reset periodically based on benchmark rate a/c to the changing market conditions.

- Based on option

- Put option: This feature gives bondholders the right but not the obligation to sell their bonds back to the issuer at a predetermined price and date. These bonds generally protect investors from interest rate risk.
- Call option: This feature gives a bond issuer the right, but not the obligation, to redeem his issue of bonds before the bond's maturity at predetermined price and date.

- Based on redemption

- Single redemption: In this case, principal amount of bond is paid at the time of maturity only.

→ Multiple redemption / Amortizing bond: A bond, in which payment ~~may~~ made by the borrower over the life of the bond, includes both interest and principal, is called an amortizing bond.

- When interest rate is expected to fall in the future, then bond-holders will be ~~not~~ willing to put-back the bond ~~as~~ because ~~price~~ ~~a~~ return from the bond is going to decrease

~~When interest rate is expected to rise in the future, then~~

- When interest rate is expected to fall in the future, then ~~the~~ issuer is more likely to call back the bond ~~as~~ and the bond-holder will also be willing to sell the bond at the higher price (due to lower interest rate), but the call price is already fixed, so the issuer can buy back the bond at the lower ~~as~~ call price.
- Whereas if the interest rate is expected to rise, then the price of bond will fall & even if the issuer buys back the bond at the higher call price, then if he wants to issue it again then he will have to pay a higher interest rate : there will be less probability of the issuer calling back the bond in this scenario.

## \* PSU Bonds

- PSU bonds are medium or long term debt instruments issued by Public sector Undertakings (~~PSUs~~ (PSUs)). The term usually denotes bonds issued by the central PSUs (i.e. PSUs funded by and under the administrative control of the Government of India).
- Most of the PSU Bonds are sold on Private Placement Basis to the targeted investors at Market Determined Interest Rates. Often investment bankers are roped in as arrangers to this issue.
- Most of the PSU Bonds ~~are~~ are transferable and endorsement at delivery and are issued in the form of Issuance Promissory Note. PSU bonds are issued in demat form.
- In order to attract the investors and increase liquidity, issuers get their bonds rated by rating agencies like CRISIL, ICRA, CARE, etc. Some of the issues may be guaranteed by Central / State Government enabling them to get a better rating.
- The maturity of PSU bonds varies between 5 to 10 years. The default ~~rates~~ rates of PSU bonds are negligible and they are perceived as quasi sovereign bonds.

- The bonds issued by PSUs are of two types, viz. taxable and tax-free.
- The provisions of tax free bonds are contained in section 10(15)(iv)(h) of IT Act which allows complete exemption of interest income arising from notified PSUs bonds.
- The major investors in PSU bonds are banks, mutual funds, insurance companies, provident funds and individuals.
- PSU bonds are generally less risky than other corporate bonds because PSUs are backed by govt.

## STOCK MARKET

Stock is a certificate that represents a partial ownership in a company.

- The investor in a stock also gets a partial ownership in the company.
- Primary or New Issue Market
- Secondary Market

The stocks are issued for the first time in the primary market. Corporates raise funds from this market by Initial Public

## Offerings (IPO).

~~Stocks~~ Stocks are transferred from one investor to other in the secondary market. Companies don't get any funds from these transactions. Investors can liquidate their stocks in this market. And price is determined by the demand and supply forces.

### Types of stocks

- i) Ordinary or Common Stock
- ii) Preference Share

Ordinary/ Common Stock	Preference Share
------------------------	------------------

- |                                                 |                                             |
|-------------------------------------------------|---------------------------------------------|
| (i) Voting rights are given to the shareholders | (i) Voting rights are not given.            |
| (ii) Dividend payment is not mandatory.         | (ii) Dividend payment is mandatory & fixed. |

If the company becomes insolvent and gets liquidated, then preference share-holders are preferred to be paid their dues. They are less exposed to the risk due to insolvency of the company.

If a company earns profit of Rs 100 & pays Rs 20 as interest for debt. Then if it pays 20% tax:

Rs 100 → Profit

- 20 → Interest

Rs 80

- 16 → 20% tax

Rs 64 (Profit after tax)

Then the company may pay some percent of the profit after tax as dividends to its shareholders. The amount remaining after paying dividends is the retained earnings.

There are 2 components of return for the investors:

- (i) Capital appreciation
- (ii) Dividend payment.

If a stock is bought for Rs 50 & in the next period, its price becomes 55, then the company pays Rs 5 capital appreciation. And if the dividend is Rs 2, then the total cashflow = Rs 7.

Dividend is treated as a signal for the market. Once a company starts giving dividend, then it generally doesn't stop but if it stops giving dividends then it is considered as a signal that the company maybe going in loss.

## \* Types of Preference Share.

- 1) • Convertible: They can be converted to ordinary share based on the terms and conditions fixed at the time of issuance of ~~to~~ the share.
- Non-convertible: Cannot be converted to ordinary share at any point of time. ~~not~~
- 2) • Cumulative: If the dividend is paid at some time due to some reason, then the dividend of that period has to be paid in the next period along with that period's dividend, i.e. the ~~di~~ fixed dividend payment is cumulative in nature.
- Non-cumulative: If for some reason a dividend payment is not paid in a certain period, then the investor has to forgo that period's payment i.e. it is not paid in the next period.
- 3) • Redeemable: Matures in a fixed period of time.  
e.g. Debenture.
- Non-redeemable: ~~does~~ not mature in any period of time. For the whole life, the share will be held by the investor and dividends will be paid by the company.

- 4) • Participating: Participating preference share-holders can earn higher dividends if the company earns higher profit, i.e. dividend is not fixed in nature.
- Non-participating: Dividends are fixed in nature.

## \* Valuation of equity

- Two approaches:
  - (i) Discounted Cash Flow Technique
  - (ii) Relative Valuation Technique.
- Discounted Cash Flow Technique tries to find the intrinsic or real value of the bond.
- Relative valuation technique finds the value of one bond relative to other to estimate the profits in investment.
- Discounted Cash Flow Technique:
  - Present value of all future cash flows.
  - (i) Cashflow
  - (ii) Growth rate of the cashflow
  - (iii) Discount rate
  - (iv) Time period.
- Cashflows: Capital appreciation is not paid regularly, it is the profit that an investor can get if he sells the share. Regular

cashflows are dividends and operating cashflows  
and free cashflows.

- Dividend
- Operating cashflow
- Free cashflow.

$$\text{Operating cashflow} = \text{Net Income} + \text{Depreciation} + \\ \text{Change in working capital}$$

$$\text{Free cashflow} = \text{Operating cashflow} - \text{capital} \\ \text{expenditure} + \text{net debt issued.}$$

Capital expenditure is the total investment  
in fixed capital.

Net debt includes both the new debt issued  
as well as the debt that was redeemed.

$$\text{Growth rate of cashflow} = \frac{\text{Retention ratio}}{\text{ROE}} \times \text{ROE}$$

$$\text{Retention ratio} = \frac{\text{Retained profit}}{\text{Net profit}}$$

$$\text{Return On Equity (ROE)} = \frac{\text{Net profit}}{\text{Total equity}}$$

If we are considering dividend cashflow, then the discount rate is the cost of equity or the required rate of return ~~from~~ of the equity.

$$CAPM = R_f + \beta(R_m - R_f)$$

$$\text{Growth rate} = \text{Retention Rate} \times \text{ROE}$$

$$\text{ROE} = \frac{\text{Net Income}}{\text{Total Equity}}$$

i) Growth rate of equity is constant

$$\boxed{\text{Value of the share} = \frac{\text{Dividend per share}}{r-g}}$$

$r \rightarrow$  growth rate of equity (cost of equity)

$g \rightarrow$  growth rate of cashflow.

$$P_0 = \frac{D_1}{(1+r)} + \frac{D_2}{(1+r)^2} + \dots + \frac{D_n}{(1+r)^n}$$

$$P_0 = \frac{D_0(1+g)}{(1+r)} + \frac{D_0(1+g)^2}{(1+r)^2} + \dots + \frac{D_0(1+g)^n}{(1+r)^n} \quad \text{if } g \text{ is constant,} \quad \textcircled{1}$$

$$P_0 \left[ \frac{1+r}{1+g} \right] = D_0 \left[ \frac{1+g}{1+r} \right] \left[ \frac{1+g}{1+r} + \frac{(1+g)^2}{(1+r)^2} + \dots + \frac{(1+g)^{n-1}}{(1+r)^{n-1}} \right]$$

$$\frac{P_0}{(1+g)} \left[ \frac{(1+g)}{1} + \frac{(1+g)^2}{(1+g)} + \frac{(1+g)^3}{(1+g)^2} + \dots + \frac{(1+g)^{n-1}}{(1+g)^{n-1}} \right] \quad (2)$$

$$(2) - (1) \cancel{\frac{P_0}{(1+g)}} \quad P_0 \left[ \frac{1+g-1}{1+g} \right] = D_0 \left( 1 - \frac{(1+g)^n}{(1+g)^n} \right)$$

If  $\alpha > g$  when  $n \rightarrow \infty$   $\frac{(1+g)^n}{(1+g)^n} \rightarrow 0$ .

$$P_0 \left[ \frac{\alpha-g}{1+g} \right] = D_0.$$

$$P_0 = \frac{D_0(1+g)}{(\alpha-g)} = \frac{D_1}{\alpha-g}$$

$P_0 = \frac{D_1}{\alpha-g}$  Constant rate of growth of dividend,  
required rate of return  $>$  growth rate of dividend.

$P_0 \rightarrow$  Intrinsic price.

- If Market price  $>$  Intrinsic price, then the stock is overvalued.
- If Market price  $<$  Intrinsic price, then the stock is undervalued & the market price is expected to go up.

## 2) Two-Stage Growth Model

- Initially, for a ~~certain~~ period of time, ~~there is a very high~~ growth rate which is unstable and then growth rate comes down and remains stable for the rest of the period.

Value of stock = PV of dividend during extra-ordinary phase + PV of terminal price.

$$P_0 = \frac{DPS_t}{(1+r)^t} + \frac{P_n}{(1+r)^n}$$

$$P_n = \frac{DPS_{n+1}}{r - g_n} \quad g_n \rightarrow \text{stable growth rate} \\ r \rightarrow \text{required rate of return.}$$

$g$  → Extraordinary growth rate of dividend for the first ~~n~~ years.

$DPS_t$  → Expected dividend per share for the period  $t$ .

$r$  → Cost of equity

$P_n$  → Terminal price at the end of  $n$  years.

$$P_0 = DPS_0 (1+g) \left[ 1 - \frac{(1+g)^n}{(1+r)^n} \right] + \frac{DPS_{n+1}}{(r-g_n)(1+r)^n}$$

$$P_0 = DPS_0 (1+g) \left[ 1 - \frac{(1+g)^n}{(1+r)^n} \right] + \frac{DPS_{n+1}}{(r-g_n)(1+r)^n}$$

Example: Earnings Per Share = Rs 10.16

52% Earnings are paid as dividend.

(i) Growth rate = 4%

Required rate of return = 12%

$$EPS = 10.16$$

$$DPS = \text{Rs } 5.28$$

$$P_0 = \frac{5.28 (1+0.04)}{0.12 - 0.04} = 68.64$$

(ii) Length of high growth period = 4 years.

Stable growth rate after 4 years = 3%.

Dividend payout ratio in the stable period = 60%.

$$P_0 = \frac{DPS_0(1+g)}{(1+g)^4} \left[ 1 - \frac{(1+g)^4}{(1+g)^4} \right] + \frac{DPS_5}{(1-g_n)(1+g)^n}$$

$\alpha - g$

$$\mu = 0.12 \quad g = 0.03 \quad g_n = 0.04$$

$$DPS_0 = R\$ 5.28$$

~~5.28 / 5.28(1+0.03)~~

$$P_n = \frac{0.6 \times 10.16 (1.04)^4 (1.03)}{(0.12 - 0.04) (1.12)^4} = 81.62$$

$$\frac{P_n}{(1+g)^n} = \frac{81.62}{1.12^4} = 51.87$$

$$\frac{0.52 \times 10.16 (1.03)^4}{(1.12)^4} = \cancel{17.21} \quad 17.21$$

$$P_0 = 81.62 + 17.21 = 98.83$$

- Dividends are generally sticky in nature, i.e. a company does not change the growth rate of dividend frequently because it gives a wrong signal to the market.

- Free cashflow to equity = Net income + Depreciation expenses - Capital exp.  
- change in working capital - principal debt payments + new debt issued.

Discount rate = cost of equity  
Net Income = Profit after tax.

\* Operating cashflow = EBIT (1 - taxrate) + Depreciation expenses - Capital Expenditure - Change in working capital - Change in other assets.

EBIT = Earnings before Interest and Tax.

Through operating cashflow, valuation of equity is done.

Valuation of firm  $\Rightarrow$  Valuation of debt =

Valuation of equity = Difference b/w valuation of firm ~~and~~ and debt.

Discount rate = Cost of capital

(Weighted average cost of capital)

$$50\% \text{ Debt} \quad \left. \begin{array}{l} WACC = w_D \times \text{cost of debt} + \\ w_E \times \text{cost of equity} \end{array} \right. \\ 50\% \text{ equity} \quad \left. \begin{array}{l} \\ \\ w_D = 0.5 \quad w_E = 0.5 \end{array} \right. \\ = 0.5 \times 7\% + 0.5 \times 10\% = 8.5\%$$

If a company does not pay dividends, then free cashflow model can be used for valuation of equity.

## \* Relative Valuation

- Value of the company can be determined by comparing it with a similar stock.
- Variables used for comparison:  
Earnings, Cashflow, Book value, Sales
- Price to Earnings Ratio Technique.

Value of the stock is calculated on the basis of the expected earnings.

$$\boxed{\text{Earnings Multiplier} = \frac{\text{Current price}}{\text{Earnings per share}}}$$

$$P = \frac{D_1}{r-g}$$

$$\frac{P}{E_1} = \frac{D_1/E_1}{r-g}$$

$\frac{D_1}{E}$  = Dividend payout ratio

$r_1$  → Discount rate

$g$  → Growth of the dividend

$$\boxed{\frac{P}{E_1} = \frac{D_1/E_1}{r-g}}$$

Example : EPS<sub>0</sub> = 2.75

~~50%~~ 50% earnings are given as dividend.  
 $g = 5\%$        $r_1 = 12\%$

$$\frac{D_0}{E} = 2.75 \times 0.5 = 1.375$$

$$\frac{P}{E} = \frac{1.375(1+0.05)}{2.75(0.12-0.05)} = 7.5$$

If any of the variable,  $D/E$ ,  $r$  or  $g$  changes then the price-earnings ratio is going to change.

e.g.  $D/E = 50\%$ ,  $r = 15\%$ ,  $g = 10\%$ .

$$\frac{P}{E} = \frac{0.5(\text{cancel})}{0.15-0.1} = 8.33$$

$$g = 10\% \rightarrow 11\% \quad \frac{P}{E} = \frac{0.5(\text{cancel})}{0.15-0.11} = 13.875$$

$$\frac{P}{E} = \frac{D/E}{r-g}$$

- If  $r$  (discount rate) increases, price-earnings ratio decrease.
  - If  $g$  (growth rate of dividend) increases, price-earnings ratio increases.
  - Price-Earnings ratio represent the price of the stock to be invested to get 1 unit of earning or return.
- e.g.  $\frac{P}{E} = 16$  means that if Rs 16 is invested in the stock, then the company gets 1 unit of earning.

- Price - Earnings ratio is an indicator of growth. If P/E ratio is low, then the stock is considered to be undervalued, and it is considered that it has high growth potential & is expected to grow in the future.
- Stocks with ~~is~~ low P/E ratio are called value stocks.
- Stocks with high P/E ratio are called growth stocks.
- Limitations: If earnings per share is negative, ~~then~~ i.e. company has made -ve profit (loss), then P/E ratio cannot be used as an investment strategy. in the market.  
→ In some sectors, earnings are quite volatile or variable ~~&~~ i.e. the sectors which are seasonal in nature. In this case also P/E ratio cannot be used. These type of stocks are called seasonal stocks.
- P/E ratio is called the Earnings Multiple.
- Price to Book Ratio (P/B)
- Book value of the company includes the book value of debt as well as the book value of equity.

- Book value of assets include the historical cost, and the depreciation ∴ book value of assets decrease with time.

$$\frac{P_0}{E_1} = \frac{D_1/E_1}{r - g_n} = \frac{\text{EPS}_0 \times (\text{payment ratio}) \times (1+g)}{r - g_n}$$

\*  $\text{EPS}_0 = \text{ROE} \times \text{Book value of equity}$

$$\text{ROE} = \frac{\text{Net Income}}{\text{Total equity}}$$

$$P_0 = \text{ROE} \times \text{Book value of equity} \times \text{Payout Ratio} \times (1+g)$$

$$\qquad \qquad \qquad r - g_n$$

$$\boxed{P_0 = \frac{\text{ROE} \times (\text{payout ratio}) \times (1+g)}{r - g_n}}$$

- ∵ Price to book ratio is directly proportional to ROE & payout ratio & inversely proportional to the discount rate.

$$g = \text{Retention ratio} \times \text{ROE}$$

$$\text{Retention ratio} = 1 - \text{Payout Ratio}$$

$$g = (1 - \text{payout ratio}) \times \text{ROE}$$

$$\therefore (1 - \text{payout ratio}) = \frac{g}{\text{ROE}}$$

$$\boxed{\text{Payout Ratio} = 1 - \frac{g}{\text{ROE}}}$$

$$\frac{P}{BV} = ROE \left(1 - \frac{g}{ROE}\right) (1+g)$$

$1-g_n$

$$\frac{P}{BV} = \frac{(ROE - g_n)(1+g)}{1-g_n}$$

$$\boxed{\frac{P}{BV} = \frac{(ROE - g_n)(1+g)}{1-g}}$$

- $\therefore$  P/BV ratio is directly proportional to ROE & inversely to the required rate of return.
- If P/BV ratio is low, then the market value of the stock is less than its book value,  $\therefore$  if other fundamental variables are favourable then the stock is considered to be ~~not~~ undervalued & is expected to grow in the future.
- Even if Earnings per share are -ve, the ~~not~~ price to book ratio can be calculated which was a limitation in case of Price-Earnings ratio.
- Price-to-Sales Ratio

$$P_0 = DPS,$$

$1-g_n$

$$P_0 = \frac{EPS_0 \text{ (payout ratio)} (1+g_n)}{1-g_n}$$

$$\boxed{\text{Net profit margin} = \frac{\text{Earnings per share}}{\text{Sales per share}}}$$

$$P_0 = \frac{NPM \times \text{Sales per share} \times (\text{payout ratio})(1+g_n)}{r-g_n}$$

- NPM/per share represents the profit that the company is able to generate from the net sales it is making.

$$\text{Profit margin} = \frac{\text{Net profit}}{\text{Total sales}}$$

$$\frac{P_0}{\text{Sales per share}} = \frac{\text{NPM} (\text{payout ratio})(1+g_n)}{r-g_n}$$

- Price-to-Sales ratio is directly proportional to NPM & inversely to the required rate of return.
- When profit margin is high, the firm has high price-to-sales ratio but when NPM falls, it has dual effect.
- It has a direct effect on P/S ratio which leads to fall in P/S ratio. Also, the profit margin leaves the growth rate which has an indirect effect on the P/S ratio.

$$g = \text{Retention ratio} \times \text{ROE}$$

$$g = \text{Retention ratio} \times \frac{\text{Net profit}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total equity}}$$

$$g = \text{Retention ratio} \times \frac{\text{NPM} \times \text{Sales}}{\text{BV of equity}}$$

$$\text{NPM} = \frac{g \times \text{BV of equity}}{\text{Sales} \times \text{Retention ratio}}$$

Q.  $\boxed{\text{NPM} = \frac{g \times \text{BV of equity}}{\text{Sales} \times \text{Retention ratio}}}$

- $\therefore$  NPM can also be represented in terms of growth rate & the retention ratio.
- Price-to-sales ratio is ~~never~~ never negative and also P/S ratio is not as volatile as other ratio like P/E or P/BV.

Low NPM, High P/S  $\Rightarrow$  Overvalued.  
 High NPM, Low P/S  $\Rightarrow$  Undervalued.

<del>EPS</del>	<del>P/S</del>	Low	High
<del>High</del>	NPM	Low	Correct Overvalued
<del>Low</del>		High	Under valued
			Correct

## SECONDARY EQUITY MARKET

- Secondary equity market is where securities are traded after being initially offered to the public in the primary market and/or being listed on the stock exchange.
- The securities are traded, cleared, and settled within the regulatory framework prescribed by the exchanges and the SEBI.
- The secondary market operates through two mediums, namely, the over-the-counter (OTC) market and ~~the~~ the exchange-traded market.
- Stock Exchanges in India
- Currently, there are 20 organized stock exchanges existing in India. Particularly, there are two prominent stock exchanges in India i.e. Bombay Stock Exchange (BSE) and National Stock Exchange (~~and~~) of India (NSE).
- The BSE was established in 1875 and it is the Asia's first stock exchange and one of India's leading exchange ~~group~~ groups.
- BSE's popular equity index - the S&P BSE SENSEX - is India's most widely ~~traded~~ tracked stock market benchmark index.

- NSE was promoted by leading financial Institutions at the behest of the Government of India and was incorporated in November 1992.
- Most popular index in NSEI has been CNX Nifty.
- Stock Market Index
- Objectives
  - To judge the performance of individual investors
  - To measure the market rates of return, and to predict the market movements.
  - Factors affecting the construction of stock market index.
    - Sample, it should be representative of total population.
    - Base year, it should be a normal year.
    - Weighting criteria, equally weighted series, price weighted series, market value weighted series and free float market capitalization weighted series.
  - An index of the market can be used to

compare the performance of an investor with respect to the market. If the return an investor is getting is more than the market index, then the investor is performing better & vice-versa.

### • Free-float market capitalization

- It takes into consideration only those shares issued by the company that are readily available for trading in the market.
- It generally excludes promoters' holding, government holding, strategic holding and other ~~locked-in~~ shares that will not come to the market for ~~at~~ trading in the normal course.
- In other words, the market capitalization of each company in a free-float index is reduced to the extent of its readily available shares in the market.
- Market capitalization = Price \* no. of shares.
- Free-float market cap. = Price \* (no. of readily available shares)

- Construction of Index

Stock	Quantity	Base Yr. Price.	Current price	Free float factor
A	60000	30	45	0.55
B	20000	25	80	0.75
C	90000	65	85	0.95

- Equally weighted series:

$$\frac{1}{3} \left( \frac{45}{30} + \frac{80}{25} + \frac{85}{65} \right) = 2.0033$$

• 2.0033 implies that if the base value of the index is 100 then the current value of the index will be  $100 * 2.0033$  i.e. the current value of the index is 2.0033 times the base value of the index.

- Price weighted series:

$$\frac{45 + 80 + 85}{30 + 25 + 65} = 1.75$$

- Market value weighted series:

$$\frac{60000 * 45 + 20000 * 80 + 90000 * 85}{60000 * 30 + 20000 * 25 + 90000 * 65} = 1.46$$

- Free float market value weighted series:

$$\frac{60000 * 45 * 0.55 + 20000 * 80 * 0.75 + 90000 * 85 * 0.95}{60000 * 30 * 0.55 + 20000 * 25 * 0.75 + 90000 * 65 * 0.95} = 1.43$$

- If the base value of the index has been taken as 100, then in the current year the value

of the index using different weighting series will be as follows:

- (i) Equally weighted : 200.33
- (ii) Price weighted : 175
- (iii) Market value weighted : 146
- (iv) Free float market value weighted : 143.

### Features of Major Stock Indices in India and Abroad.

Indices	Sample	Base Year	Base Value	Weighting Criteria
S&P BSE	30	1978-79	100	Value weighted from the beginning, but since Sept 1, 2003 it uses free float methodology
SENSEX				
CNX NIFTY	50	November 3, 1995	1000	Value weighted from the beginning, but since June 26, 2009 it uses free float methodology.
DJIA	30	1938	100	Free float
S&P Composite	500	1941-42	10	Value
NYSE	2818	1965	50	Value

e.g. If the ~~index~~ index in some year  $Y_1$  was 150 & after 10 years, in year  $Y_2$ , it becomes 60,000 i.e. it has increased by 400 times. Then the value of investment of 100000 becomes 40000000.

Symbol Date Open High Low Closing Traded volume

Symbol	Date	Open	High	Low	Closing	Traded volume	Value of trades	P/E	P/B	Dividend Yield	52-week high	52-week low
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
CNX Nifty	30/6/14	7534.05	7623.65	7531.6	7611.35	152303166	7887.37	20.65	3.48	1.29	7700.05	5818.85
SB1	30/6/14	2650.00	2706.95	2645.5	2686.25	389993	136.80	18.45	1.36	1.11	2834.90	1452.75

Column I : Symbol: It represents the name of the company (Index).

Column II: Date: This represents the date of transaction or trade.

Column 3: Open: It represents the price at which a security ~~is~~ first trades upon the opening of an exchange on a given trading day.

Column 4-5: High & Low: This indicates the price range at which the stock has traded ~~at~~ throughout the day or these are the maximum and the minimum prices that investors have paid for the stock.

Column 6: Closing: The close is the last trading price

recorded when the market closed on the day.

Column 7: Traded volume: This figure shows the total number of shares traded for the day.

Column 8: Value of trades: It indicates the total value of trades happened in the day.

Column 9: (Price/Earnings ratio): This is calculated by dividing the current stock price by earnings per share. It indicates how much investors are willing to pay per unit of earnings.

Column 10: (Price/Book Value ratio): This is used to compare a stock's market value with its book value. It is calculated by dividing the current closing price of the stock by the latest quarter's book value.

Column 11: Dividend yield: It is the percentage return on the dividend. It is calculated as annual dividends per share divided by price per share.

Column 12 & 13 (52-week high & low): These are the highest and lowest prices at which a stock has traded over the previous 52 weeks (1 year).

- Types of investors.

- Investors

- The goal of the investor is to participate in the market over a long period of time through the buying and holding of the stocks to maximize his return.

- Traders

- Involve frequent buying and selling of stocks with the objective of generating returns more than the returns received from buy and hold investing. For traders, profits are generated through buying at a lower price and selling at a higher price within a short period of time.
- Traders are generally categorized into four types on the basis of their investment horizon period.

- (i) Position trader: Positions are held from months to years.
- (ii) Swing Trader: Positions are held from days to weeks.
- (iii) Day Trader: Positions are held throughout the day and no overnight positions.
- (iv) Scalp Traders: Positions are taken seconds to minutes and no overnight position.

## • Stock Market Liquidity

- A stock market is said to be liquid if traders can quickly buy or sell large numbers of shares with minimal impact on price, cost and delay.
- Liquidity has been emerged as multidimensional: Width, Depth, Immediacy and Resiliency
- Width, referring to the bid-ask spread: The difference b/w the price the seller asks for (ask price) and the price the buyer bids (bid price) is the bid-ask spread. Larger the spread, lower is the liquidity. If the bid-ask spread is low, then there is less ~~width is number of~~ information gap b/w the buyer and the seller and the transaction cost is low ∴ the market is more liquid.
- Depth is the number of shares that can be traded at given bid and ask prices i.e. the trading volume. ∴ if the depth or trading volume is large, then the liquidity of the market is large.
- Immediacy refers to how quickly trades of a given size can be done at a given cost
- Resiliency characterizes how fast prices revert to former levels after they changed

in response to large order flow imbalances initiated by uninformed traders.

- Sometimes, some traders buy or sell a large number of stocks at the same time, and take a very large position in the market which drastically ~~effect~~ affects the price.  $\therefore$  Resilience is defined by the time it takes to settle back to the former price. If the time taken is less, then the market is more resilient, thus more liquid.
- Trading System
- Order driven market and quote driven market
- The Order driven market displays all of the bids and asks, while the quote driven market focuses only on the bids and asks of market makers or the institutional investors.
- In an order driven market, there is no guarantee of order execution, but in the quote driven market, there is that guarantee.
- In the order driven market, if ~~the~~ a buyer bids Rs 50 & some seller asks for Rs 50, then they are a match & trade will take place. But if a match is not found, then trading will not happen, thus there is no guarantee.

- In India the stock exchanges adopt the order driven system.

### • Types of Orders

- Limit Price / Order : An order that allows the price to be specified while entering the order into the system. If the price reaches that particular limit, then only the order will be executed.
- Market Price / Order : An order to buy or sell securities at the best price obtainable at the time of entering the order i.e. the lowest price at which you are ready to buy & the highest price at which you are ready to sell.
- Stop Loss (SL) Price / Order : The one that allows the Trading Member to place an order which gets activated only when the market price of the relevant security reaches or crosses a threshold price. Until then the order does not enter the market.

### • Margin Trading

- For purchasing the stocks on margin, investors must open an account, which is called as margin account with their broker and put up some cash as collateral.

- The initial deposit is referred to as the initial margin. The investors are required to satisfy a maintenance margin, which is the minimum amount of margin that they must maintain as a percentage of stock's value (owner's equity).
- If the stock's value declines, the investor's equity value also declines, so that the investor's equity may no longer represent the minimum percentage of the stock's value required by the broker. In this case the investor receives a margin call from the broker, which means that the investor is required to provide more collateral (i.e. more cash or stocks) or sell the stocks.

Initial = amount of money investor puts up  
margin      Total value of transaction

Actual = Current value of securities - amount borrowed  
margin      Current value of securities

- Margin call arises when the actual margin is declining below the maintenance margin.

Margin call = Amount borrowed  
price      No. of shares(1 - maintenance margin percentage)

- Let the price of a stock is Rs 100 and an investor wants to ~~not~~ buy 100 stocks :  
 $100 \times 100 = \text{Rs } 10000$ . But the investor has Rs 5000 & the investor borrows Rs 5000 from the broker.

∴ Initial margin =  $\frac{\text{Rs } 5000}{\text{Rs } 10000} \times 100\% = 50\%$

If the price of the stocks come down to Rs.90.  
 $\therefore$  Actual value =  $90 \times 100 = 9000$   
 Actual margin =  $\frac{9000 - 5000}{9000} = 0.44 \rightarrow 44.44\%$

Actual margin should not be below the maintenance margin.

Let maintenance margin = 30%

∴ Now,  $44.44 > 30 \rightarrow$  Actual margin > Maintenance margin.

But if the price comes down to Rs 70.

Then the current value =  $70 \times 100 = 7$

$$\text{Actual margin} = \frac{7000 - 5000}{7000} = 0.2857 \rightarrow 28.57\%$$

- Now the actual margin is less than the maintenance margin & the investor will get a margin call to deposit the required money in the brokerage account.

$$\text{In this case, margin call price} = \frac{5000}{100(1-0.3)} \\ = \text{Rs } 71.42.$$