UNIT III – BONDS AND DERIVATIVES

IMPORTANT

1. **Dear students, please go through unit I and II carefully before starting on this unit. The terms and concepts discussed under this unit take their inputs from previous 2 units. So to get the fair share of understanding here, make sure you have been through concepts discussed before.**
2. **We have used the calculated values of PVIF (Present value Interest factor) and PVIFA (Present Value Interest Factor of Annuity) to narrow down the calculations in many examples. These values could be found in the Appendix table of any textbook.**
3. **Given to the technical nature of this unit, it may just be a little difficult to grasp everything in first reading. So we suggest to read with consistency and take mandatory help from any books available with you, preferably the following:**
    1. **Security Analysis & Portfolio Management, Fisher & Jordon**
    2. **Security Analysis & Portfolio Management, V.A. Avadhani**
    3. **Security Analysis & Portfolio Management, Punithavathy Pandian.**

BOND BASICS:

- A contract that requires the borrower to pay an interest income to the lender.
- Resembles a promissory note issued by Govt. or a corporation.
- Has a par value/face value – stated on the bond paper
- Interest rate is also known as coupon rate - paid quarterly, bi-annually or annually.

BOND RISK:

Due to fixed interest, an investor generally takes bonds as riskless. However this notion is wrong since bonds do involve some risk.

1. **Interest rate risk**: Risk in relation to the market interest rates (MIR). For instance the bond value declines if market interest rate moves up.
   A 14% bond is valued high if MIR drop to 13%. Accordingly, the same bond is undervalued if MIR moves up to 15%.
2. **Default Risk:** Failure on part of the issuer to pay agreed value in full or on time and/or both.
3. **Marketability Risk**: Variations in return caused by difficulties in selling the bonds. An investor may find it difficult to sell a particular bond he holds due to various company specific reasons like image and listing problems.

- A bond may become illiquid owing to the downgrading of a bond by some rating agency.
- This risk is different from market risk, insofar as this risk is specific to a company.
- Investor is forced to sell this bond at huge discounts.

4. **Callability Risk**: The uncertainty caused in the investor's return due to issuer's ability to call back the bonds anytime.

Given to the uncertainty regarding the maturity period, the investor is not sure about the amount of interest he would earn - so he is likely to ask for higher eyelid. Such bonds are high interest bonds.

VALUATION OF BONDS

Bonds are generally valued on the basis of returns (interest) an investor gets from them and the maturity value/redemption value.

Perpetual Bonds: These bonds have no maturity value and are valued on the basis of interest rates.

$$V = \sum I/(1+K_d)^t \ldots\ldots$$

Where “t” varies from 1 to infinity.

I is the interest rate

Kd is the Discount rate/required rate of return

Since “t” could vary to infinity, we also express this formula as:

$$V = I/K_d$$

Example: Investor buys a bond that pays the interest of Rs. 120 per year forever and his ROR on this bond is 15%. Calculate the PV.

Soln. V = 120/0.15

V = 800

So if the current market price is < 800, it’s worth buying.

Bonds with Maturity:

They pay terminal/maturity value in addition to the interest rate.

$V = I/(1+K_d)^t + MV/(1+K_d)^n$

$V = I \times 1/(1+K_d)^t + MV \times 1/(1+K_d)^n$ ……… Where MV is the Maturity Value

Example: Suppose interest of 120 is payable for 10 years , ROR is 15% and at maturity Rs. 1000 is payable. Calculate the present value.

Soln. V = 120 (5.019) + 1000 (0.247) …

Using **PVIFA (Present Value Interest Factor of Annuity)** values and **PVIF (Present Value Interest Factor)** values table.

PVIFA is the present value of series of future annuities (in our case 10 years)

PVIF is the present value of Future Sum (1000 in this case)

V = 849.28

Zero Coupon Bonds:

These bonds do not make periodic interest payments, so the interest part in the formula is removed and the bonds are valued as:

$V = MV/(1+K_d)^n$

BOND RETURN – HOLDING PERIOD RETURN

Return that an investor gets while holding a bond for some (holding) time.

$$HPR = \frac{\text{Price gain or loss during the holding period + Coupon Interest rate}}{\text{Price at the beginning}}$$

Example: An investor purchases a bond at Rs. 900 with Rs. 100 as coupon payment (Interest) and sells it at Rs. 1000. What would be the holding period return for this bond?

Soln: $$\frac{\text{Price gain (100) + Coupon rate (100)}}{\text{Beginning Price (900)}}$$

= 200/900

= 0.2222 or 22.22%

Now if the same bond is sold for R. 750, there is the loss of R. 150 and the HPR would be:

$$\frac{-150 + 100}{900}$$

= -50/900

= - 0.0555 or - 5.5%

The HPR would always be negative when fall in bond price is more than the coupon payment.

YEILD TO MATURITY

The rate of return an investor can expect to earn if the bond is held till maturity. YTM is calculated on the basis of certain assumptions:

- There should not be any default on part of the issuers, i.e. the coupon, principle should be paid in full and on time.
- Bond to be held till maturity.

- All coupon payments to be reinvested immediately at the same interest rate as YTM.

Example: A four year bond with a 7% coupon rate and maturity value of Rs.1000 is currently selling at Rs. 905. What is the YTM?

Soln. $$\text{YTM (Y)} = \frac{C + [P \text{ or } D/\text{Years to maturity}]}{(Po + F)/2}$$

Where ,

C is coupon Interest

P or D is premium or discount

Po is the present value

F is the face value.

$$\text{YTM} = \frac{70 + (95/4)}{(905 + 1000)/2}$$

= 93.75/952.5 = 0.098 or YTM = 9.8%

SIGNIFICANCE OF YTM

YTM could be used to calculate the present value of the bond returns.

Example: A Rs. 100 par value bond with the coupon rate of 11 % matures after 5 years. The expected YTM is 15%. If the present market price is Rs 82, can the Investor buy it?

Soln.

$$PV = \frac{\text{Coupon}}{(1+Y)^t} + \frac{\text{Maturity price (Pm)}}{(1+Y)^n}$$ …………………… where Y is Yield to maturity.

= 11 x 3.3522 + 100 x 0.4972 ……… using corresponding PVIFA & PVIF values from the table.

= 36.87 + 49.72

= 86.59

The present value of the bond Rs. 86.59 is more than the present market price of Rs. 82. The bond is underpriced and investor can buy it.

BOND VALUE THEOREMS

The value of bonds depends on three factors – Coupon rate, years to maturity and expected YTM.

Theorem 1:

If the market price of the bond increases, the yield would decline and vice versa.

Example:

Factors	Bond A	Bond B
Par value	1000	1000
Coupon rate	10%	10%
Maturity Period	2 Yrs	2 Yrs
Market Price	874.75	1035.66
Yield	?	?

$$\text{YTM (Y)} = \frac{C + [P \text{ or } D/\text{Years to maturity}]}{(Po + F)/2}$$

Bond A:

$$Y = \frac{100 + (125.25/2)}{(874.75+1000)} = \frac{100+62.62}{1874.75/2}$$

$$= \frac{162.62}{1874.75\ /2}$$

$$= \frac{162.62}{937.37} = \mathbf{17.34\%}$$

Bond B:

$$Y = \frac{100 + (-35.66/2)}{(1035.66)/2} = \frac{100-17.83}{2035.66/2}$$

$$= 85.17/1017.83 = 0.080 = \mathbf{8\%}$$

THEOREM 2

If the bond yield remains the same over its life, the discount or premium will depend on tenure /maturity period.

Example:

Factors	Bond A	Bond B

Par value	1000	1000
Coupon rate	10%	10%
Maturity Period	2 Yrs	3 Yrs
Market Price	918.71	885.86
Yield	15%	15%
Discount	81.29	114.14

Using YTM (Y) = $\dfrac{C + [P \text{ or } D/\text{Years to maturity}]}{(Po + F)/2}$

Bond A

$$Y = \frac{100+(81.29/2)}{(918.71+1000)/2}$$

$$= \frac{100+40.64}{1918.71/2}$$

= 140.64/957.35 = 0.1465 = **14.65% or 15%**

Bond B

$$Y = \frac{100+(114.14/3)}{(885.86+1000)/2}$$

$$= \frac{100.38.04}{1885.86/2}$$

= 138.04/942.93 =0.1463 = **14.63% or 15%**

Hence if YTM is same over life of the bond, it's better for investor to sell the bond as soon as possible. Because more the number of years he holds the bond, higher the discount he would have to sell the bond at and/or lower the premium he would sell at.

Theorem 3

A rise in bond's price for a decline in bond's yield is greater than the fall in bond's price for a rise in the yield.

Example: Consider a bond with coupon rate as well as the yield of 10% and maturity of 5 years with the face value of Rs. 1000.

(a) If the yield declines by 2% and remains 8%, find the Bond value.

Soln: $PV = \frac{\text{Coupon}}{(1+Y)^t} + \frac{\text{Maturity price (Pm)}}{(1+Y)^n}$

$= 100/(1+Y)^t + 1000/(1+Y)^n$

$= 100 \times 1/(1+Y)^t + 1000 \times 1/(1+Y)^n$

= 100 x 3.9927 + 1000 x 0.6806 …. Using corresponding PVIFA and PVIF values

= 399.27 + 680.6

= **1079.87**

(b) If the yield increases by 2%, what will be the Bond Value/price?

Soln. PV = 100 x 3.6048 + 1000 x 0.5674 …. Using corresponding PVIFA and PVIF values

= 360.48 + 567.4

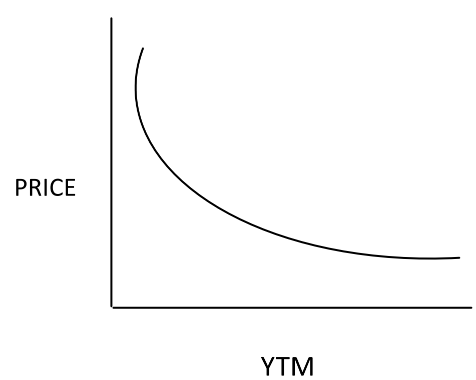
= **927.88**

So the 2% fall in the yield resulted in the rise of Rs. 79.87 in price and 2% rise in the yield resulted in the fall of Rs 72.12 in price.

BOND CONVEXITY:

The graphical relationship between the bond's price and the bond yield.

This relationship is inverse as proved in the theorem 1 of the bond valuation. It states, If the market price of a bond increases its yield would decline and vice versa.



While talking about the convexity one has to keep the theorem 3 under consideration. Which says, The quantum increase in the bond's price for a given decline in the yield is higher than the decline in bond's price for a similar amount of increase in bond's yield.

Convexity is applicable to all bonds and its degree differs from bond to bond depending upon the factors like Bond size, tenure, market price etc.

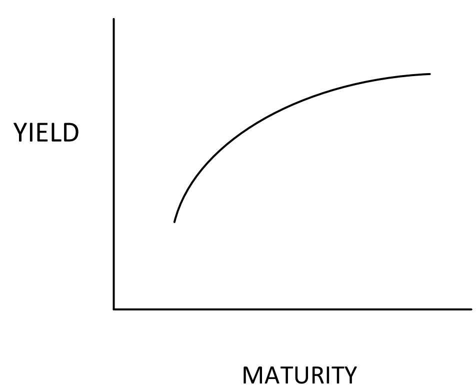
TERM STRUCTURE OF INTEREST RATES:

Term structure is the relationship between yield and time /years to maturity. It is a graphical relationship and is also called the "Yield Curve".

In other words, the structure of yields that is observed for bonds with different terms of maturity.

Fluctuations in the interest rates could be categorized as short term, medium term and long term. In term structure we deal with the long term or the Secular trend fluctuations that could last several business cycles.

In analyzing the effect of maturity on yield all other influences like risk, tax, redemption possibility etc are held constant.



Relationship between Yield and maturity – Term structure

There are three competing theories that attempt to explain the term structure of interest rates.

The Expectations Theory:

This theory was developed by J.R.Hicks (1939), F. Lutz (1940 AND B. Malkiel (1966).

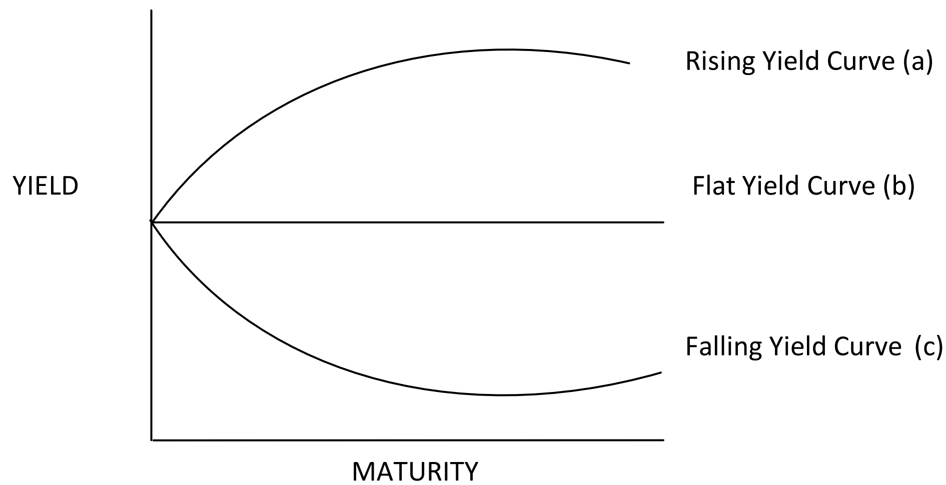
According to them the shape of the curve can be explained by the expectations of the investors about the future interest rates. In short term the interest rates are expected to be relatively low in future, then the long term rate will be low as well.

There are three reasons for investors to anticipate fall in the interest rate.

(a) Anticipation of fall in inflation rate and reduction in inflation premium
(b) Anticipation of balance d budget or cut in the fiscal deficit.
(c) Anticipation of recession in the economy & fall in the demand for funds by private companies.

In contrary, the long term rates will exceed the current short term rates if there is the expectation of market rates being higher in future.

Thus the yield curve depends upon the expectations of the investor.



(a) Indicates investors expectations of continuous rise in interest rates
(b) Interest rates to remain constant
(c) Expects rates to decline.

LIQUIDITY PREFERENCE THEORY (LPT)

This is part of the Keyne's theory that was advocated by J.R. Hicks in 1939.

"It is desirable for the investor to invest in short term bods than the long term bonds – because of liquidity.

If there is no attractive premium for holding the long term instruments, investor will go for the short term ones and he will have to be motivated by the issuer to lengthen his investment horizon and this is done by offering attractive premiums.

SEGMENTATION THEORY

Liquidity is not always the preference for an investor as pointed out by the critics of the LPT. They said – insurance companies, pension funds and even retired persons prefer long term securities to avoid possible fluctuations in interest rates.

An Insurance company for instance doesn't have to pay for longer durations to the policy holders, rather gets premiums from them. If it invests the collective premiums in bonds, it would help in two ways. It earns fixed interest and reduces risk as well. The only thing to be taken care of is that the bond returns must be higher than the promised rate of return to the policy holders. Now if the same company invests in short term (one year) bond, it runs the risk of reinvestment. Further if market interest rates go down, it will lose big time. So it will always prefer investing in long term instruments.

Statement: “The supply of and demand for funds are segmented in sub markets because of preferred habits of individuals. Thus the yield is determined by the demand for and supply of funds”

One would like to invest somewhere (supply) and demand interest, other may like to raise finds (demand) and pay interest in turn.

RIDING THE YIELD CURVE

When the bond portfolio manager tries to exploit the upward slopping yield curve (where long term coupon rates are higher than short term rates) by purchasing the long term bonds – this strategy is known as riding the yield curve.

Riding will benefit only when market interest rate doesn't rise. Increasing MIR may cause the capital loss to the investor.

BOND DURATION

Measures the time structure of the bonds and it's interest rate risk.

There are two ways to express the time structure of the bond.

A) How many years an investor has to wait for a bond to mature and get the principal amount back. ..This is also called the asset time to maturity” or simply the years to maturity.
B) Average time taken for al interest coupons and principal to be covered …… **Macaulay's Duration.**

Definition: Duration is the weighted average of periods to maturity , with weights being present value of cash flows in each period.

$$D = \sum \frac{PV_c}{P_o} \times t$$

$$D = \frac{C_1/(1+r)}{P_o} + \frac{C_2/(1+r)^2}{P_o} \ldots\ldots + \frac{C_t/(1+r)^t}{P_o} \quad x \quad t$$

Where,

D is the Duration

C is the Cash flow

R is the current Yield to maturity

T is the number of years

PV_c is the present value of the cash flow.

P_o is the sum of present values of cash flow.

Example: Calculate the duration for bonds A and B with maturity period of 4 years and coupon rate of 7% & 8% respectively. The face value is Rs. 1000 and current yield for both the bonds is 6%.

Soln. Using the formula

$$D = \frac{C_1/(1+r)}{P_o} + \frac{C_2/(1+r)^2}{P_o} + \frac{C_3/(1+r)^3}{P_o} + \frac{C_4/(1+r)^4}{P_o} \quad x \;\; 4$$

<u>Bond A</u>

Year	Cash Flow	$1/(1+r)^t$	PVc	$\frac{C_t/(1+r)^t}{P_o}$	$\frac{C_t/(1+r)^t}{P_o}$ x t
1	70	0.943	66.01	0.0638	0.0638
2	70	0.890	62.30	0.0602	0.1204
3	70	0.8396	58.77	0.0568	0.1704
4	70	0.7921	847.55	0.8191	3.2764
		P_o =	1034.63		**D = 3.6310**

<u>Bond B</u>

Year	Cash Flow	$1/(1+r)^t$	PVc	$\frac{C_t/(1+r)^t}{P_o}$	$\frac{C_t/(1+r)^t}{P_o}$ x t
1	80	0.943	75.44	0.0706	0.0706
2	80	0.890	71.20	0.0666	0.1332
3	80	0.8396	67.17	0.0628	0.1884
4	80	0.7921	855.47	0.8000	3.2000
		P_o =	1069.276		**D = 3.5922**

We have used the PVIFA values for the yield of 6% for the corresponding year from the table and also calculated the Present value of cash flows using the formula below…

$$PV = \frac{Coupon}{(1+Y)^t} + \frac{Maturity\ price\ (Pm)}{(1+Y)^n}$$

So the bond with higher coupon payments has the shorter duration compared to the bond with lower coupon payment.

IMMUNIZATION

A technique that allows the bond portfolio holder to be relatively certain about the promised stream of cash flows. In immunization process, the coupon rate risk and the price risk can be made to off set each other.

Increase in market interest rate (MIR) causes the bond prices to fall (of those issued already), but newly issued bonds offer higher interest rates. The coupon can be reinvested in the bonds offering higher interest rates & the losses that occur due to fall in bond prices can be offset and the portfolio is said to be immunized.

DERIVATIVES – OPTIONS

A contract between two parties to buy or sell a specified number of shares at a later date for an agreed price.

An option is the right but not the obligation to buy or sell something on a specified date at a specified price.

Parties involved:

Option Seller: Also called the writer is a person who grants someone else the option to buy or sell.

Option Buyer: Pays a price to the option writer to induce him to write the option.

Option Broker: An agent finds the option buyer & seller - receives a commission or fee for it.

The option could be a **Call option** or a **Put option**.

Call Option

An option that gives the owner the right to by the underlying security /asset. An option contract shows the following.

- Name of the concerned company
- No. of shares to be purchased
- Purchase price (exercise price/strike price)
- Expiration date – date on which the contract or option expires.

Example: Investor X (writer) owns 1000 shares that were sold to him for Rs. 120/share. He enters into an options contract with person Y (owner) and gives him to right to buy (call option) 1000 shares anytime during next 2 months at Rs. 130/share (strike price/exercise price). Mr. X would charge Mr. Y some amount called the premium to provide this facility. Mr. Y pays the premium right at the time when the contract is entered into. Since Mr. Y has the right, not the obligation to exercise the contract, he may as well decide not to exercise the contract upon expiry. In that case he would incur the loss of the Premium amount (generally 2% of the strike price).

If the contract is exercised, the person X earns the profit of Rs.10 per share. Now during this time of 2 month market prices may go below Rs.130, which means Mr. Y could buy the same shares at lower rates from elsewhere and he may decide not to exercise the contract. In this case Mr. X just earns the premium paid to him by Mr. Y. Another side of this deal is that prices may also rise above Rs.130 in these 2 months. In that case Mr. Y exercises the contract and buys the shares for Rs.130 as agreed and later sell them at whatever price in the market.

Put Option

This option gives an owner the right to sell (put) the underlying asset or security. In this case the owner makes other person (writer) to write the option that he would buy from owner in future and pays premium to the writer.

Example: If investor X predicts future fall in price of stock from existing level of Rs.120/share. He can make the person Y to write the options contract (put option) and buy this options contract from him by paying him some premium. He can buy a put option for 1000 shares at the strike price of Rs.130.

If the premium is Rs.1/share – X must pay Rs.1000 to Y.

Now if price falls to Rs.115 – X will gain because he has bought the right to sell at Rs.130. But if the price goes up to Rs.135 or more, He won’t exercise the option & loss is only premium of Rs.1000.

Some other types of Options

Covered option: The option is covered if Investor sells the option against the stock held in his portfolio.

Naked option: Sells the option without the stock to back them up – in association with associate seller.

Out of money option: When strike price exceeds the market stock price option is said to be out of money.

If strike price is Rs.130 and market price falls to Rs.125. Prospect loss for the buyer if he exercises the option

In the money option: If market stock price goes up than the strike price.

If strike price is Rs.130 and market price rises to Rs.135. There is prospect gain for the buyer if he exercises the option.

DERIVATIVES - FUTURES

A contract that calls for the delivery of either a physical asset or financial instrument at a specified date/ during specified period of time, for an agreed piece. It is a "firm legal commitment" between a buyer and a seller in which they agree to exchange something at a specified price at the end of designated period of time.

The regulatory authorities specify the **Margin Money** to be deposited to ensure that each party follows through with his/her side of transaction.

Future is an obligation both for buyer and seller. It shows:

- Amount and type of asset.
- Delivery/maturity date – period of type
- Place & process of delivery

Futures are traded in organized exchanges and traded until the expiry of the contract

How do futures work?

Hedgers buy and sell futures to offset the risky position in the market. For example and Indian exporter expecting to receive $10000 (taking for instance 1$ today = Rs.66) value from his exports in coming months may sell a future to save from Dollar depreciation. This way the future buyer is assured of the supplies.

If speculator anticipates the rise in dollar price, he buys the future at current dollar price and sells them at higher price to get some short term gains.

Types of Futures

- **Commodity Futures**
- **Financial Futures**

Commodity Futures: These futures involve some commodity to be delivered to the future buyer at an agreed price. For example a farmer producing wheat (currently selling at Rs. 100/kg) expects the prices to fall due to low demand. He enters into a futures contract with a particular buyer wherein they agree for the delivery of 1000 KGs of wheat at a price of Rs.100/kg in two months' time from now. This is how the farmer will hedge his position in future and save from price fluctuations.

Financial Futures: The financial futures could be currency futures, interest rate futures and stock futures.

Stock futures are written on a specified stock and the person who buys these futures is said to have taken a **Long position** in the market (or simply called as **Long**) and the one buying this future is called as **Short** or has taken the **Short position**.

The traders of futures get the benefit of the price changes without actual delivery of the stock. For example a stock future of ABC company operates for 3 months from January to March and the market price is Rs.200/share. If investor X anticipates the prices to rise by Rs.50/share and at the same time investor Y by his own analysis expects the prices to fluctuate either below or above Rs.200/share. X will buy the future and Y out of his risk aversion will sell the future at for instance the negotiated price of Rs.220/share and hedges himself from risk. X can sell the future anytime during the contract or hold them till contract expires. If for example prices in February rise to Rs.240/share, X will sell the future and earn the profit of Rs.20/share.

TRADING/OPERATIONS

To trade a future on (say) NSE an investor needs to pay an initial upfront margin to the broker as a security deposit. A proper margin account is to be maintained for this upfront margin he pays and everyday position of this investor in the market reflects from his margin account. This margin amount called **Initial margin** should be as much that it can cover one day price fluctuations at least.

For instance, investor X buys 100 shares of a company as a future contract at the price Rs.1400/share with upfront margin of 5%, which is Rs.7000. The exchange assesses the position of this investor every day and marks this position to his account. Any gain is credited to the account and any loss is debited. If on a day, the price is Rs.1420, he position shows gain and receives the profit (**called mark-to-market profit**) of Rs.1420-1400X100 = 2000. Now, if the price falls to Rs.1390, his position will show the loss of Rs.1000 and this amount will be debited to the margin account. If at any time the margin amount due to losses goes below Rs.7000, a call (Margin Call) is made to the investor and he needs to maintain this minimum balance.

Maintenance margin: Minimum amount of margin money that must be maintained in margin account. If amount in the margin account goes below this maintenance margin, a call is made.

Variation Margin: Amount needed to be paid to restore the required balance in the margin account.

STOCK INDEX FUTURE

A future contract made for the stock index, rather than the individual stock.

If for instance, the value of the Nifty Index is at 5000. Then the value of Nifty stock index future is given as 500 X 50 = 25000.

Where 50 is the number of scrips making the index as well as the price of individual scrip. If at the end of contract, nifty is at 510, the settlement amount would be (510-500) X 50 = 500. The transactions on a settlement day are settled in cash and no delivery of stock is actually made.

INDEX ARBITRAGE

An index future indicates the investor's expectations about the future of the stock market. When investors are optimistic the future prices are higher and when pessimism prevails, the future prices are lower. The price of the futures contract doesn't generally vary much from the cost of carry from the spot price, but when this happens, arbitrageurs step in.

An arbitrageur is a person who simultaneously purchases and sells the same of essentially similar security in 2 different markets for different prices to get some advantage. His action forces the price of the stock index future contract to remain close to the current level of underlying index.

Example: On a particular day in mid-year, an investor has Rs.20000 to invest for 6 month. On this day the Sensex futures contract is selling at Rs.22000 and Sensex stock at Rs.20000 at the dividend of 4% and return on a T-bill investment is 5%. Two investment options are available – either to invest in Index stock or in Index futures.

Strategy 1:

If he invests in Sensex stock and holds on to it till December, he would get the dividend of **Rs.800** (4% of 2000) and the stock value (as it would be then).

Strategy 2

If he wants to invest in Index futures contract, he doesn't have to pay Rs.20000 at once, because futures contract doesn't need him to pay that much at the time of entering into the contract. He just needs to pay the minimum margin amount. So to avoid keeping his money idle, he may invests this Rs.20000 in a T-bill and use this T-bill as margin in futures contract (T-bill can be used as margin amount) and buy a 6 months Sensex Futures contract of Rs.22000. The gains from this investment would be 5% from T-bill, which is Rs.1000. But upon expiration of futures contract he would also have to pay Rs.2000, because value of the T-bill is just Rs.20000 and that of future he bought is Rs.22000.

In nut shell, it is the loss of Rs.1000 for him in this investment:

1000 (T-bill return) + 20000 (T-bill value) – 22000 (futures contract) = **-1000**

As an arbitrageur, the investor can go long or buy I strategy 1 and go short or sell in strategy 2. He can buy the Index shares and keep them till December and sell Index future and treasury bill – both of which mature in December. In his way, the net cash paid by him will be zero. He buys index stock and pays Rs.20000 and sells a T-bill to receive Rs.20000. He can use the purchased stock of Rs.20000 as margin amount and sell index future for Rs.22000. If index value remains Rs.20000 at the expiration the arbitrageur can gain Rs.2000 on expiration date by getting Rs.22000 from Index future. He will also get the dividend of Rs.800 by holding the Stock for 6 months, but will have to forgo the interest on the Treasury bill, which is 5% of its value (Rs.1000).

So the net gain from this arbitrage will be:

Gain from index future (22000-20000) + Dividend gain from index stock (0.04 x 20000) – interest from treasury bills (1000)

= 2000 + 800 – 1000

= Rs.1800

So the investor has maximized his returns by going long in strategy 1 and short in strategy 2. But this won't go on forever because more players would come in to gain this profit, more would buy the index stock and that will take price of the stock higher. At the same time more would go short on Index futures and that would reduce the prices of the futures below 22000. This would go on till the equilibrium is attained and there won't be any further gains and arbitrage will stop.

HEDGING & FUTURES

Hedging can simply be called as guarding your position in the market from possible future price fluctuations. Hedging is called the "**Long Hedge**" when investor takes the long position in futures and goes short on underlying stock.

Example: An investor A holding XYZ stock currently trading at Rs.200 anticipates short term rise in the price. He sells 100 shares now and buys a 3 month Stock future currently trading at Rs.195. If upon expiration the stock price goes up to Rs.210, he would gain Rs.15 – because as per contract he only has to pay Rs.195. But at the same time he would have to forgo Rs.10/share which he could have earned by keeping the stock for 3 months and selling them directly at Rs.210.

Now hedging could also be **"Short Hedge"** when investor goes short on futures and takes long position on stock.

If the similar XYZ stock is trading at Rs.200, but investor perceives future (short term) fall in price. He would sell XYZ futures currently trading at Rs.195. If price upon expiration falls to Rs.190, the investor A saves Rs.5/share.

TERMS TO REMEMBER

<u>Warrants</u>: A call option to buy stated no. of shares at specified price on a specified date which is generally years. It is exercisable for longer or could be called to have longer shelf life.

<u>Spreading</u>: Spreading in derivatives means purchase of one option and sale of another - both on the same stock. If both the options have same exercisable price but one expires before/later than the other, we call it the **"Time Spread".** But if both expire on same date but have different exercisable price, we call it the **"Price Spread".**

<u>Collar</u>: The stock price that is collared between two strike prices is known as collar.

Example: Investor sells an out-of-money call option and buys an out-of-money put option. This helps him to hedge his long position in the underlying stock.

The lower strike price for put option is called **"Floor".** And high strike price for call option is called **"Ceiling".** If the investor buys and sells the option at the same premium, the total cost is zero. This called **Zero Cost Collar**.

<u>STRADDLE:</u> An option trading strategy where investor takes an offsetting position in the market for possible future gains. Straddle could be **LONG** when investor **<u>buys</u>** a put and a call option at the same strike price & expiry date.

Example: Price of a bid stock is Rs.100 and investor anticipates price fluctuations in future. He buys a call and a put option with same strike price of Rs.110 and pays a premium of 2 + 2 = 4. If price increases to Rs.115, he exercises the call option and gains Rs.115-110=5 and leaves the put option to expire (doesn't exercise). Net gain from this trade is 5-2-2=1

Now if price falls to Rs.105, he exercises the put option and leaves the call option to expire, saving Rs.5 again and gaining 5-2-2=1 from this transaction as well.

Now the straddle could be **SHORT** as well which involves **<u>Selling</u>** put and a call option at same strike price and same expiry date simultaneously.

Example: Investor A sells a call & a put option at Rs.110 and takes the premium of Rs.2+2=4. If price falls to Rs.105, byer of the call option won't exercise and A gains the premium of Rs.2. However buyer of the put option may exercise the put option given to the fact that he has bought the right to sell the stock at Rs.110, so investor A would lose 105-110 = -5

Overall gain/loss would be 2(premium on call option) + 2(premium on put option) – 5(loss on put option price) = -1

This is to be noted that investor may gain even in Short straddle, which depends upon the %age of price change.

BUTTERFLY SPREAD

A butterfly spread is a neutral option strategy combining bull and bear spreads. Butterfly spreads use four option contracts with the same expiration but three different strike prices to create a range of prices the strategy can profit from. The trader sells two option contracts at the middle strike price and buys one option contract at a lower strike price and one option contract at a higher strike price. Both puts and calls can be used for a butterfly spread.

1. Buy one call at (x-a) Strike price (S1)
2. Sell two calls at X strike price (S2)
3. Buy one call at (X+a) strike price (S3).

Where X is the middle strike price or the price investor bought the option at (Bid), say 100 and "**a**" is the 10% variation in the strike price.

Operations: If bid stock price is say Rs.100.

- Buys one call option with strike price of (x-a) or 100-10 = 90 (S1) and pays a premium of Rs.5 for this.
- Sells 2 call options with strike price of Rs.100 or X (S2) at premium of Rs.2 each …. (Takes the premium of 2+2=4)
- Buys one call at the strike price of (X+a) or 100+10 = 110 (S3) at premium of Rs.1 (pays)

The total cost for this investment is Rs.2

Now if the stock price moves to Rs.97.

Loss/Gain in the first (Buy) position = (97-90)-5 =>7-5 = **2 (Profit Gain)**

Loss/Gain from 2 sold options = 2+2 = **4 (Premium Gain)** …. Calls won't be exercised though due to strike price being more than 97.

Loss/Gain from the 4th position = **1 (premium Loss)** ….. Call won't be exercised though….. strike price being more than 97.

So the net gain from the operation of this Butterfly spread = 2+4-1 = 6-1 = 5

Similarly the butterfly Spread can be created by taking positions in put options.