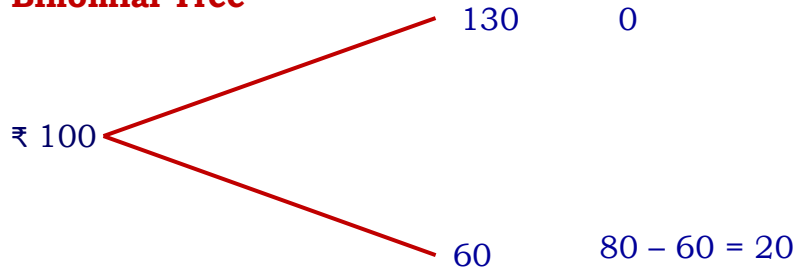


If the risk-free rate of interest is 8% then what will be value of abandonment option.

Solution:

(i) Binomial Tree



(ii) Risk Neutral Probability

$$30 P + (-40) (1 - P) = 8$$

$$30 P - 40 + 40 P = 8$$

$$70 P = 48 \quad P = \frac{48}{70} = 0.686$$

(iii) Value of Abandonment Option

$$\text{Value} = \frac{(0 \times 0.686) + (20 \times 0.314)}{1.08}$$

$$= ₹ 5.81 \text{ Cr. (Put option)}$$

Question – 44

Suppose MIS Ltd. is considering installation of solar electricity generating plant for light the staff quarters. The plant shall cost ₹ 2.50 crore and shall lead to saving in electricity expenses at the current tariff by ₹ 21 lakh per year forever.

However, with change in Government in state, the rate of electricity is subject to change. Accordingly, the saving in electricity can be of ₹ 12 lakh or ₹ 35 lakh per year and forever.

Assuming WACC of MIS Ltd. is 10% and risk-free rate of rate of return is 8%.

Decide whether MIS Ltd. should accept the project or wait and see.

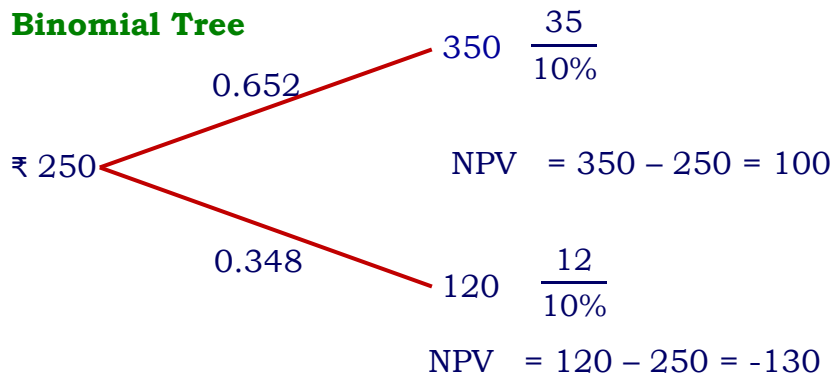
Solution:

If Project Install New

$$\begin{aligned} \text{NPV} &= \text{PVCI} - \text{PVCO} \\ &= \frac{21}{10\%} - 250 \text{ lacs} \\ &= -40 \text{ lacs (0.4 Crore)} \end{aligned}$$

Wait for 1 year

(i) Binomial Tree



(ii) Risk Neutral Probability

- Return if PVCI = 350
 $= \frac{350 - 250}{250} \times 100 = 40\%$
- Return if PVCI = 120
 $= \frac{120 - 250}{250} \times 100 = -52\%$

$$40 P + (-52) (1-P) = 8$$

$$40 P - 52 + 52 P = 8$$

$$92 P = 60$$

$$P = \frac{60}{92}$$

$$= 0.652$$

(iii) Value of Abandonment Option

$$\begin{aligned} \text{Value} &= \frac{(100 \times 0.652) + (-130 \times 0.348)}{1.08} \\ &= ₹ 18.48 \text{ lacs} \end{aligned}$$

It is better to wait for 1 year due to higher NPV.

Question – 45

ABC Ltd. is a pharmaceutical company possessing a patent of a drug called 'Aidrex', a medicine for aids patient. Being an approach drug ABC Ltd. holds the right of production of drugs and its marketing. The period of patent is 15 years after which any other pharmaceutical company produce the drug with same formula. It is estimated that company shall require to incur \$ 12.5 million for development and market of the drug. As per a survey conducted the expected present value of cash flows from the sale of drug during the period of 15 years shall be \$ 16.7 million. Cash flow from the previous similar type of drug have exhibited a variance of 26.8% of the present value of cash flows. The current yield on Treasury Bonds of similar duration (15 years) is 7.8%. Determine the value of the patent.

$$\text{Given } \ln(1.336) = 0.2897$$

$$e^{-1.0005} = 0.3677 \text{ and } e^{-1.17} = 0.3104$$

Solution:

Given

$$E = \$ 12.5$$

$$So = \$ 16.7$$

$$t = 15 \text{ years}$$

$$\text{Variance} = 0.268$$

$$\sigma = \sqrt{0.268} = 0.5177$$

$$r = 0.078$$

$$y = 1/15 = 0.0667$$

Step 1 d_1 & d_2

$$\begin{aligned}
 d_1 &= \frac{\ln \frac{S_0}{E} + \left[(r - y) + \frac{\sigma^2}{2} \right] t}{\sigma \sqrt{t}} \\
 &= \frac{\ln \frac{16.7}{12.50} + \left[(0.78 - 0.0667) + \frac{0.268}{2} \right] 15}{\sqrt{0.268} \times \sqrt{15}} \\
 &= \frac{\ln 1.336 + 2.1795}{2.005} \\
 &= \frac{0.2897 + 2.1795}{2.005} = 1.2315
 \end{aligned}$$

$$\begin{aligned}
 d_2 &= d_1 - \sigma \sqrt{t} \\
 &= 1.2315 - 2.005 \\
 &= -0.7735
 \end{aligned}$$

N (d_1)

N (1.2315)

1.20 ————— 0.1151

1.25 ————— 0.1056

————— 0.0095

$$0.1151 - \left(\frac{0.0095}{0.05} \times 0.0315 \right) = 0.1091$$

$$N(d_1) = 1 - 0.1091 = 0.8909$$

N (d_2)

N (-0.7735)

$$N(d_2) = 0.2196$$

Value of Patent

$$\text{Value of patent} = S_0 e^{-yt} \times N(d_1) - E e^{-rt} \times N(d_2)$$

$$\begin{aligned} &= 16.7 \times e^{-0.0667 \times 15} \times 0.8909 - 12.5 \times e^{-0.078 \times 15} \times 0.2196 \\ &= 16.7 \times e^{-1.0005} \times 0.8909 - 12.5 \times e^{-1.17} \times 0.2196 \\ &= 16.7 \times 0.3677 \times 0.8909 - 12.5 \times 0.3104 \times 0.2196 \\ &= \$ 5.4707 - \$ 0.8520 \\ &= \$ 4.619 \text{ Millions.} \end{aligned}$$

DERIVATIVES THEORY

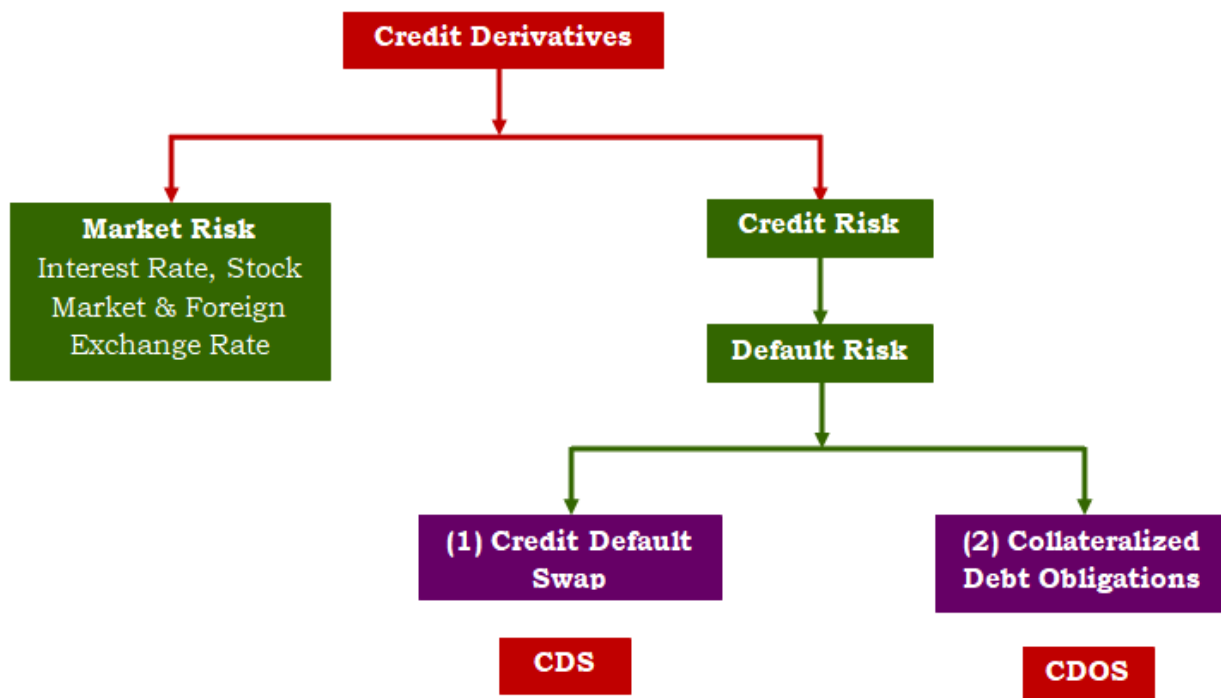
- (1) Exotic Option
- (2) CDS & CDO'S
- (3) Weather Derivatives
- (4) Electricity Derivatives
- (5) Derivatives Mishaps & Lesson
- (6) Option Greeks

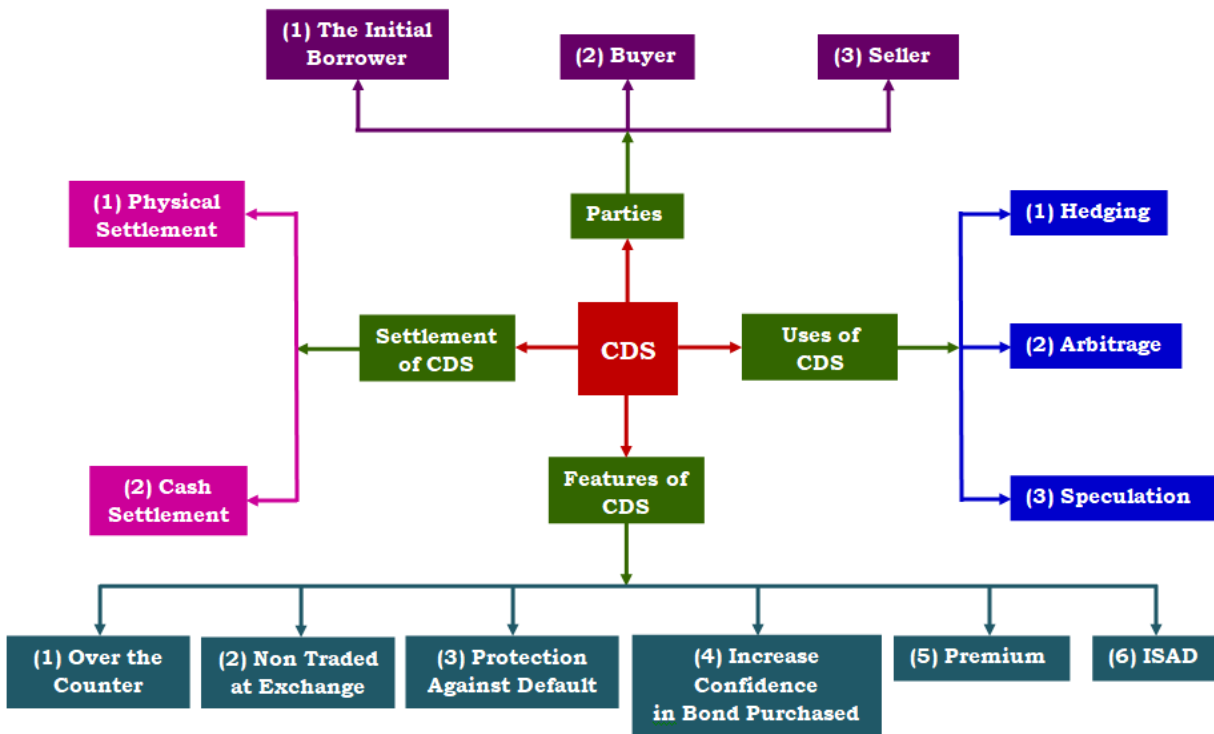
(1) EXOTIC OPTION

- Different From Plain Vanilla Option
 - Hybrid of American & European Option
 - Vary In Term of Payoff
 - More Complex
 - Traded at OTC
- 1. Barriers Option:** Become activated only if price reaches a certain price.
 - 2. Chooser Option:** Right to the buyer after a specified period whether option is call or put.
 - 3. Compound option:**
 - Split fee option or Option on option.
 - Underlying asset is an option.

4. **Look Back Option:** Choose a most favorable strike price depending on the minimum & maximum price.
5. **Asian Option:** Payoff are determined by average of the price.
6. **Bermuda Option:** Exercise is restricted to certain date.
7. **Binary Option:**
 - Payoff shall be pre decided amount.
 - Happening of a specific event.
8. **Basket Option:** Instead of one asset, depends on value of portfolio
9. **Spread Option:** Depends on difference between price of two assets.

(2) CDS & CDO'S



(I) CREDIT DEFAULT SWAP (CDS)**(II) COLLATERALIZED DEBT OBLIGATION (CDOS)****Types of CDOS**

1. **Cash flow CDOS:** Transfer of asset to SPV.
2. **Synthetic CDOS:** Credit Risk is transferred by originator without actual transfer of assets.
3. **Arbitrage CDOS**

Risk Involved in CDOS

- (i) **Default risk:** Prime sufferers of risk “Junior tranche”
- (ii) **Interest Rate Risk:** Floating Asset v/s fixed Liabilities
- (iii) **Liquidity Risk**
- (iv) **Prepayment Risk**
- (v) **Reinvestment Risk**
- (vi) **Foreign exchange Risk**

(3) WEATHER DERIVATIVES

- Risk faced by company whose performance is liable to be affected by the weather i.e. airline companies, juice manufacturing.
- To manage volumetric risk from unfavorable weather, weather derivative is introduced [Rainfall, temperature, humidity, wind speed etc.]
- To hedge value Risk [change volume due to change weather]
- Insurance v/s weather derivatives
- Parties in weather derivatives
- Problems in pricing of weather derivatives
 - * **Data** → Differs country to country
 - * **Forecasting of Weather** → Difficult to predict
 - * **Temperature modeling** → No perfection

(4) ELECTRICITY DERIVATIVES

- Risk faced by company having requirement of electricity for long form basis.
- Electricity spot price in India are volatile hence there is a need for hedging instrument to reduce price risk.
- This will help the buyer to pay fixed price irrespective of variation in spot electricity prices
- Electricity derivatives are
 - (i) Forward
 - (ii) Future
 - (iii) Swap

(5) DERIVATIVE MISHAPS & LESSONS

1. Orange country's
2. Barings Bank's Case

3. Protector & Gamble & Gibson Greetings Case

(1) ORANGE COUNTRY [1994]

- Municipality
- Treasurer Robert Citron [No background in trading]
- Use derivative is yield curve [Bonds]
- Over leveraged
- In 1994, Interest rate rise then bond price fall
- Loss \$ 1.5 billion orange country doubted bankrupt.

(2) BARINGS BANK'S CASE [1995]

- Nick Leeson
- Arbitrage [Singapore S.E & Osaka market-Nikkei 225 future]
- Huge losses, to cover-up loss, started taking speculation]
- Influence the staff of Bank office to hide losses
- In 1995, Leeson take short position in Japanese Govt. Bond
- Earthquake in Japan in 95 & interest rate fall
- Barings Bank became bankrupt, Dutch Bank purchase this Bank for £ 1

(3) PROTECTOR & GAMBLE & GIBSON GREETING CASE [1994]

- Banker Trust [BT]
- Complicated derivative "Leverage Swap"
- Floating v/s fixed
- LIBOR Rise
- In 1994, Huge loss

LESSONS

- (i) Don't buy any derivative product that you don't understand.
- (ii) Due diligence before making treasury department as profit centre.
- (iii) Specify the risk limit
- (iv) Separation of front, middle & back offices
- (v) Ensure that a hedger should not become a speculator
- (vi) Carry out stress test, scenario Analysis etc.

(6) OPTION GREEKS

Price of option depends upon following factors.

- (1) Stock price (S_0)
- (2) Exercise price (E)
- (3) Time (t)
- (4) Volatility (σ)
- (5) Rate of Interest (R)

Among these factors, exercise price is constant, remaining factors may change. Option price will change due to change in these factors. We wish to carry out sensitivity analysis i.e.

Rate of change in option price with respect to each factor, keeping other factors constant. This rate of change has been assigned in Greek Letter.

(I) DELTA

- (i) Delta means rate of change in option price with respect to stock price. Since call is bullish & put is bearish hence call has positive delta & put has negative delta.
- (ii) Suppose delta of call 0.4 & Delta of put – 0.6 means.
 - If means if price of stock goes by ₹ 1 then price of call option will go up by 40 paisa & price of put option will go down by 60 paisa .