# CIFA

# DERIVATIVES ANALYSIS

# SECTION 6

# STUDY TEXT

# PAPER NO: 18

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- The role of options markets

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# CHAPTER ONE

# INTRODUCTION TO DERIVATIVE MARKETS AND INSTRUMENTS

**Derivatives markets and instruments**

Derivatives - is a financial instrument that offers a return based on the returns of some other underlying assets i.e. its return is derived from another instrument hence the name. Derivative performance is based on the performance of an underlying instrument.

The underlying asset is often referred to the underlying and it trades in the market where buyers and sellers meet and decide on the price then the seller delivers the asset to the buyer and receives payment.

A Cash price or spot price-refers to the price you immediate purchase of the asset.

A derivative has a defined and limited life which means a derivative contract initiates on a certain date and terminates on a later date. A derivative payoff is determined and /or made or the expiration date in most cases.

A derivative contract is an agreement between two parties in which each party does something for the other e.g an insurance contract where one party pays the other and in return receives coverage against potential losses.

**Derivatives trade in the following markets;**

**Exchange Traded Market**

They have standard terms and features and they have organized derivative trading facilities e.g. a future exchange as an option exchange.

**Over the counter markets**

In these markets derivative contracts refers to any transaction created by two parties anywhere else. Such contracts are highly customized and not regulated.

## Types of Derivatives

Derivatives can be classified into two major classifications

1) Forward commitment
2) Contingent claims

# CHAPTER TWO

# FORWARD MARKETS AND CONTRACTS

A forward contract-is agreement between two parties in which one party the buyer agrees to buy from another party the seller an underlying asset or other derivatives at a future date at a price established at the start of the contract. Therefore it is a commitment by two parties to engage in a transaction at a later date with the price set in advance.

The buyer in the forward contract is often called the long and the seller is called the short.

## FEATURES OF FORWARDS

1. Forward contracts lock in the price and if by the time the seller is supposed to deliver and the price goes lower than the set price, he will still receive the set price and benefit from having locked in the price. However if prices went up he will lose the chance of enjoying high prices in the marked since he will have to pay the set forward price.

THESE ARE THE FIRST PAGES EXTRACTED FROM EVERY CHAPTER

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# CHAPTER THREE

# FUTURE MARKETS AND CONTRACTS

Futures are standardized while forwards are customized.

Futures have exchange markets; forwards have no established distinct markets. Futures have guidelines performances or pa through cleaning house while

A future contract: - is an agreement between two parties to buy or sell an underlying or another at a future state at a price agrees on today.

| **Forwards** | **Futures** |
|---|---|
| Private & customized contracts | Is a public transaction taking place in an organized futures exchange |
| All times an exposure by two parties | All the terms except for price is set by future exchange hence they are standardized |
| There's an exposure to credit | The clearing house guarantee against future credit loss through a process called marking to market |
| Forwards are highly unregulated | Futures are regulated by the government |
| Can be created at any location | Created in an organized facility called futures exchange |

The clearing house is responsible for collecting daily gains and losses as well as guaranteeing to each party the performance of the other. It is subsidiary of the futures exchange.

In a futures transaction, one party is the long (buyer) while the other party is the short (seller). The buyer / seller agree to buy / sell the underlying asset at a later date, the expiration at a price agreed at the start of the contract.

Every day the futures contract trades in the market and its price changes in response to new information. Buyers benefit from price increases while sellers benefit from price decreases.

On expiration day, the contract terminates & further trading takes place. Then either the buyer takes the underlying from the seller or the two parties markets equivalent cash settlement.

Future spot price: The spot price of the underlying asset when the contract expires is called the future spot rate, since it is market price that will prevail at some future date.

Spot price is the purchase of underlying asset for immediate delivery.

## Features of futures

1. Public standardized transactions-futures are reported in the futures exchange, the clearing house & at least a regulatory agency. The price is recorded & it's available from price reporting services even on internet hence future are public transactions. All terms to the future are standardized.

2. Homogenization & Liquidity - Futures contract are created in generally acceptable terms making them more acceptable to a broader group of participants due to homogeneity brought about by standardization. Futures can therefore easily trade in secondary market hence allows the participants in the future exchange to offset their position before expiration.

3. The clearing house daily settlement & performances guarantees futures contracts to each party the performance of other party through the clearing house. The gains and losses on each party's position are credited and charged on a daily basis on procedure called daily settlement or marking to market. In this process, paper gains & losses are converted into cash gains / losses. This process is equivalent to terminating a contract at the end of each day & reopening it the following day at the settlement price.

4. Regulations: in most countries futures are regulated by the government. The need for regulations arises and of the concerns to protect the public & other

futures markets participants & also the fact that futures market affect the economy as a whole.

## Futures Trading

A future trading is done in set up referred to as pit trading (floor based trading). It is a physical activity where traders shout out their orders of their price they are willing to pay or sell. Also use hand signals to indicate their bids or offers. They engage in transactions with other traders in the pit by simply agreeing on price and the number of contracts to trade. The activity is fast, furious & stressful. In the recent years more trading has come off to the electronic screen or terminals. In electronic or terminal based trading, exchange members enter into their bids & offers into a computer system which then displays this information & allows a trader to consummate this information electronically. A person who enters into futures establishes either a long or short position.

**Short position**:- are agreements to sell the underlying at the expiration at the price agreed at the start while the long positions to buy the underlying at expiration at a price agreed at the start expiration at price agreed at the start.

When the position is established each party deposits a small amount of money referred to as the margin with the clearing house then the contract is marked to market whereby gains are distributed to & losses collected from each party. A party that has opened a long position collects profits or incurs losses. Third party may wish to leave the market and close out the position (a process called offsetting). Offsetting is same as selling a previously purchased stock or buying back a stock to close a short position.

The holder of long future position simply goes back in the market & offers the identical contracts for sale when a party offsets a position the party doesn't necessarily do so with the same counter party to the original contract hence due to the fact that futures can offset, they are said to be tangible meaning any futures contract with any counter party, can be offset with by equivalent futures contract with another counter party. Tangibility is assured by the fact that the clearing loose inserts it is in the middle of each contract therefore becomes counterparty to each party.

## The clearing house margins & price limits

When a trader takes a long or short position in future he must deposit sufficient funds in a margin accounts

The distinction between futures margin account to equity margin account

| **Futures Margin Account** | **Equity Margin Account** |
|---|---|
| Term margin account is used to describe the mount must be put into an account by a party opening up a futures position. | Term is used in stock market refers to a loan made to reduce the amount of money required to purchase stock |
| It is expressed in % of futures price called merge % | Expressed in dollar terms |
| Maintenance margin requirement are set by clearing houses | Margin requirement are set by the government |
| Usually less than 10% of futures price | Margin % is equal to ———————— |
| Initial margin requirement refers to certain amount put up initially while the rest of the money is borrowed. | Initial margin requirement refers to the percentage of initial value of stock that is borrowed equally up to 5 percent of the initial value of stock. |
| Maintenance margin requirement refers to the level of account balance above which they must be maintained. | Maintenance margin requirement is % the above which the amount is borrowed. |

Futures clearing market set their margin requirements by studying historical price movement then establishing minimum margin levels by considering normal price movement and the facts that accounts are marked to market daily. The clearing house thus collects and disburses margin money every day. They are also permitted to do so more often than daily.

By carefully setting margin requirements and collecting margin money every day. Clearing houses are able to control the risk of default. On any day on which the amount of money in the margin account at the day falls below the maintenance

margin requirement the trader must deposit sufficient to bring the balance back to the initial margin requirement.

Alternatively the traders might close out the position but he is responsible for any further losses incurred if the price changes before any transactions can be made.

To provide a fair marked to market process, the clearing house must designate the official price for determining daily gains & losses. This price is called settlement price and it represents an average of the final few trades of the day. A closing pricing is a single value that can be particularly be priced high or low or perhaps even manipulated by traders hence clearing takes an argue of all traders during the clearing house

# CHAPTER FOUR
# RISK MANAGEMENT APPLICATIONS OF FORWARD AND FUTURES STRATEGIES

Hedging – taking a market position to protect against an undesirable outcome eg increase in interest rates. Companies do more than hedge, they may manage risk.

Manage risk-carefully consider scenarios and elect to adjust the risk they face to a level they feel is acceptable. This adjustment involves:

- Reduction of risk
- Altering the risk from current level to a level the company desires.

## STRATEGIES AND APPLICATION FOR MANAGING INTEREST RATE RISK

Many companies make plans to borrow based on their future cash needs at specific future dates. The rates they pay on these loans are important determinants of their future cash needs as reflected in their planned interest payments. Exposure to international rate risk is a major concern. Failure to manage interest rate risk can hinder planning process, as well as result in unexpected demands on cash necessitated by unexpected higher international payments.

### Managing international rate risk using FRA

a. Single payment loan

A company anticipating to borrow money in the future enters into a long position in an FRA. The FRA has a fixed rate called the FRA. If underlying rate at expiration is above the FRA rate, the company as the holder of long position receives a lump sum of cash based on the difference between FRA rate and market rate at that time. This payment helps offset the higher the rate the company would be paying on its loan. If the rate in the market falls below FRA rate, however, the company will end up paying the counterparty, thereby offsetting the lower rate it will be paying on its loan. The end result is the company pays approximately a fixed rate, the FRA rate.

Example

On 15th April GBT confirms that it will borrow $40 million at LIBOR plus 200 bp on 20th august to repay it on 15 February 180 days later. It goes long an FRA at a rate of 5.25% to expire on 20th august with the underlying being 180-day LIBOR. At AFR contract expiration 20th august the 180 day LIBOR is 6%. Calculate FRA payoff, the amount of the loan borrowed and repaid.

Solution

$$\frac{\left[\left(\text{Underlying rate at expiration} - \text{forward contract rate}\right)\text{notational principal}\right] \times \left(\frac{\text{days in underlying rate}}{360}\right)}{\left(1 + \text{underlying rate at expiration}\right)^{\left(\frac{\text{days in underlying rate}}{360}\right)}}$$

$$= \frac{40{,}000{,}000\ (0.06-0.0525)(180/360)}{1 + 0.06(180/360)}$$

= $ 145,631

GBT receives $145,631 to obtain and $40 million in cash, it borrows 40,000,000-145,631 =$ 39,854,369 at LIBOR plus 200bp ie 0.06 + 0.02 = 0.08 (8%)

On 16 February (Loan repayment)

GBT pays back $39,854,369 (1.08 x 180/360) $41,448,544

Effective payment rate = (41,448,544/40,000,000 – 1) x 360/180 = 0.00724

Net effect: GBT receives 40 million on 20th august and pays back $41,448,544 on 15th February at the rate of 7.24%

This rate was effectively locked in on 15th April at the FRA rate of 5.25% plus 200bp that GBT pays over LIBOR.

Below are 10 results from 10 scenarios

| LIBOR on 20th august | FRA payoff | Amount borrowed | LIBOR + 200bp loan rate | Amount repaid 16 Feb | Effective loan rate |
|---|---|---|---|---|---|
| 0.02 | -643,564 | 40,643,564 | 0.04 | 41,456,435 | 0.0728 |
| 0.04 | -245,098 | 40,245,098 | 0.06 | 41,452,451 | 0.0726 |
| 0.06 | -145,631 | 39,854,369 | 0.08 | 41,448,544 | 0.0724 |
| 0.08 | 528,846 | 39,471,154 | 0.10 | 41,444,712 | 0.0722 |
| 0.10 | 904,762 | 39,095,238 | 0.12 | 41,440,952 | 0.0726 |

In a similar manner, a lender could lock in a rate on a loan it plans to give by going short FRA. Lenders use this less often since its borrowers who close to take up loans, hence taking a FRA on this. The lender would be assuming a consideration risk that the loan may not even be taken. In that case, the lender would rather use an option so that in the worst case, it losses only the option premium.

b. Floating rate loan

To cover rising interest rate risk, the borrower may enter into a series of FRAs with each component FRA tailored to expire on a date on which the rate will be reset. This strategy does not lock in the same fixed rate for each period but different rates for each period will be locked in. This is done by use of future though limited due to the fact that Eurodollar futures have expirations only on specific days of the year and chances of having contracts with expirations that align to the Eurodollar payment reset dates are slim. Borrowers who want to align their interest rates reset dates with dates on which the derivatives expire can do so more easily with swaps.

Bond portfolio risk-Measuring the risk of a bond portfolio

These are the risks associated with longer term loans and they primarily take the form of bond market risk. A firm lending or issuing a bond can manage risk associated with interest rate by using futures on the bonds.

The sensitivity of a bond to a general change in interest rates is usually captured by assuming that the bond price changes in response to a change in its yield, which is driven by the general levels of rates.

The responsiveness of a bond price to a yield change is captured in 2 ways.

1. Duration
2. Basis point value.

# CHAPTER FIVE
# SWAP MARKETS AND CONTRACTS

A swap is an agreement between two parties to exchange a series of future cash flows for market types of swaps, one party makes the payments that are determined by a random outcome such as an interest rate, a currency rate, an equity return or a commodity price. These random payments are commonly referred to as variable or floating. The other party either makes variable or floating payments determined by some other random factors or makes fixed payments. At least one type of swap involves both parties making fixed payments but the values of these payments vary due to random factors.

In swaps the floating/variable rate payer or the fixed rate payer are the preferred terminologies used to designate the parties to a swap as opposed to the long and short parties terminologies used in forwards, futures and options.
The party receiving a floating rate is said to be long while the one receiving the fixed rate is said to be short. In some cases however, both parties receive floating / variables hence the terminologies doesn't apply in such cases.

### Characteristics of swaps

i. Most swaps involve multiple payments though there are times when swaps involve a single payment. Thus a swap is referred to as a series of payments. A swap with one payment is just a forward contract hence a swap is basically a series of forwards.

ii. When a swap is initiated neither party pays any amount to the other hence it has a zero value at the start of a contract with the exception of currency swaps where each party pays notional principal to the other the amount exchanged being equivalent though denominated in two different currencies.
Each date on which parties makes payments is called settlement date/payment date and the time between settlement date is called settlement period. On a given settlement date when payments are due, one party pays the other who in turn pays the first party and with the exception of currency swaps, all payments are done in the same or one currency. Consequently, parties agree to exchange only the net

amount owed from one party to the other a practice called netting. But for currency swaps parties make separate payments without netting.

iii. Swap contracts are settled in cash and not the delivering of the underlying.
iv. A swap has a termination date, the date of the final payment (expiration date)
v. Original time to maturity is called tenor
vi. A swap market is exclusively on OTC market hence swap contracts are customized to parties' specific needs. There exists a futures contract on swaps in some futures markets which enable parties to hedge and specialize on rates that will prevail in the swap markets at future dates.
vii. Futures contracts on swaps though not swaps themselves can in some ways serve as substitute for swaps considering that they are derivatives of swaps
viii. Default risk- since swaps are OTC instruments, there exists default risks throughout the contract depending on the financial conditions of the two parties.

## Termination of swaps (before expiration)

In swaps, early termination can take place in several ways
1.By a party paying the counterparty a swap market value calculated during its life and these payments terminates the swap contract as long as it was agreed in advance
2.Many swaps are terminated by entering into a separate and offsetting swap e.g. suppose a company engaged in a swap to make fixed payments of 5% and receive floating payments based on the LIBOR with payments made each 15$^{th}$ Jan and 15$^{th}$ July. 3 years remain on the swap this company could offset the swap by entering into an entirely new swap in which payments each 15$^{th}$ day of Jan and 15$^{th}$ of July for 3 yrs hence, the risk associated with the floating rate is eliminated through the default risk is not eliminated because both swaps remain in effect.

3.By selling the swap to another counterparty e.g. a company holds a swap worth $ 75,000 if it can obtain the counter party's permission it can find another party to take over payments that is settle the swap for $75,000 to that other party this is an uncommon procedure though.

**4.**By using swaptions: - this instrument is an option to enter into a swap at terms that are established in advance. Thus, a party could use a swaption to enter into an offsetting swap as described earlier.

**Types of swaps**.

1. Currency swap

In this swap, each party makes interest payments to the other in different currencies e.g. suppose a US retailer (TGT) wants to expand in Europe and due to the fact that it is unknown in Europe it can only issue fixed interest rates bonds in dollars (5 yrs USD 10M bond at 6%) then enters into a swap with DB as German bank in which DB will make payments to TGT in dollars at a fixed rate of 5.5% and TGT would make payments to DB in Euros at a fixed rate of 4.95 each 15th March and 15th September for 5 yrs. The payments are based on the notional of principal 10M in dollars and 9M in Euros. Assume that the swap starts at 15th September the current year, and the swap specify that the two parties exchange notional principal at the start of the swap and at the end of the swap.
Since payments are done in different currencies, netting is not practical so each party makes interest payments. Assuming 180 day between payment dates are the scale of this examples, the swap transaction will be as follows

| i. | ii. |
|---|---|
| 15th September | Each of 15 March and 15 Sept |
| TGT pays $10M to DB | TGT Pays 4.9% x €9M x 180/360 =€ 220,500 |
| DB Pays €9M to TGT | DB Pays 5.5% x $10 Mx 180/360 = $275,000 |

# CHAPTER SIX
# RISK MANAGEMENT APPLICATIONS OF SWAP STRATEGIES

Managing interest rate risk

The most common type of swap is a ‘‘plain vanilla’’ interest rate swap. In this swap a company agrees to pay cash flows equal to interest at a predetermined fixed rate on a notional principal for a predetermined number of years. In return, it receives interest at a floating rate on the same notional principal for the same period of time.

**Interest Rate Risk Management**

Interest rate swaps is the most widely used instrument to manage interest rate risk. Swaps are not used to manage the risk of an anticipated loan, rather, they are designed to manage the risk of a series of Cash flows on loans already taken out or in the process of being taken out.
Swaps can also be used to manage the risk associated with managing a portfolio of bonds.
Converting a floating rate loan to a fixed rate loan and vice versa using interest rate swap

**Using Swaps to adjust duration of fixed income portfolio**

The duration of a swap is equivalent to the duration of a long position in a floating rate bond and a short position in a fixed rate bond.
Duration of a swap is the net of the durations of equivalent positions in fixed- and floating rate bond and a short position in a fixed rate bond. Negative duration means that a fixed rate payer is favored by rising rates and falling market value.
Value of a bond portfolio is inversely related to interest rates.

$$NP = \frac{B\,(MDUR_T - MDUR_B)}{MDUR_S}$$

NP = Notional principal

$MDUR_T$ = Target modified duration
$MDUR_B$ = Bond modified duration
MDuRs=Modified duration of SWAP
B= M.V of bond portfolio

Managing Risks of structured notes – Leveraged floating rate notes

Structured Notes are short- or intermediate term floating rate securities that have unique features distinguishing them from ordinary floating rate notes e.g. interest rates on the note moving at a multiples of market rates or it can be inverse feature (meaning) that interest rates on notes move opposite to the market rates.

FP=Principal/face value of the note
ci= fixed interest rate on bond
Fs=fixed interest rate on the swap

Leverage floating rate note/leveraged floater is in note whose coupon is a multiple of a specific market rate of interest such as LIBOR.

Inverse floater
This is a structured note whose rate moves inversely with the specific market rate e.g. LIBOR. To hedge interest rate risk: Finance the structured note by a fixed-rate note and then swap the fixed rate for a floating rate to match the structured note. Inverse floater pays a rate of b-L

DIVERSIFICATION OF A CONCENTRATED PORTFOLIO USING EQUITY SWAP

Equity swaps can be used to achieve diversification without selling the stock. Cash flow management is a major issue in equity swap since the fixed rate payer may end up paying fixed plus any other loss (see notes on equity swaps).

LIBOR

The floating rate in most interest rate swap agreements is the London Interbank Offered Rate (LIBOR). It is the rate of interest at which a bank is prepared to deposit money with other banks that have a AA credit rating. One-month, three-month, six-month, and 12-month LIBOR are quoted in all major currencies. Just as prime is often the reference rate of interest for floating-rate loans in the domestic financial market, LIBOR is a reference rate of interest for loans in international financial markets. To understand how it is used, consider a 5-year bond with a rate of interest specified as 6-month LIBOR plus 0.5% per annum. The life of the bond is divided into 10 periods, each 6 months in length. For each period, the rate of interest is set at 0.5% per annum above the 6-month LIBOR rate at the beginning of the period. Interest is paid at the end of the period.

Illustration

Consider a hypothetical 3-year swap initiated on March 5, 2012, between Microsoft and Intel. We suppose Microsoft agrees to pay Intel an interest rate of 5% per annum on a principal of $100 million, and in return Intel agrees to pay Microsoft the 6-month LIBOR rate on the same principal. Microsoft is the fixed-rate payer; Intel is the floating-rate payer. We assume the agreement specifies that payments are to be exchanged every 6 months and that the 5% interest rate is quoted with semiannual compounding. The first exchange of payments would take place on September 5, 2012, 6 months after the initiation of the agreement. Microsoft would pay Intel $2.5 million. This is the interest on the $100 million principal for 6 months at 5%. Intel would pay Microsoft interest on the $100 million principal at the 6-month LIBOR rate prevailing 6 months prior to September 5, 2012—that is, on March 5, 2012. Suppose that the 6-monthLIBOR rate on March 5, 2012, is 4.2%. Intel pays Microsoft 0.5x0.042x$100=$2.1 million. Note that there is no uncertainty about this first exchange of payments because it is determined by the LIBOR rate at the time the contract is entered into. The second exchange of payments would take place on March 5, 2013, a year after the initiation of the agreement. Microsoft would pay $2.5 million to Intel. Intel would pay interest on the $100 million principal to Microsoft at the 6-month LIBOR rate prevailing6 months prior to March 5, 2013—that is, on September 5, 2012. Suppose that the6-month LIBOR rate on September 5, 2012, is 4.8%. Intel pays 0.5x0.048x$100=$2:4 million to Microsoft. In total, there are six exchanges of payment on the swap. The fixed payments are always $2.5 million. The floating-rate payments on a payment date are calculated using the 6-month LIBOR rate prevailing 6 months before the payment date. An interest rate swap is generally structured so that one side remits the difference between the two payments to the other side. In our example, Microsoft would pay Intel$0.4 million (=$2.5 million-

$2.1 million) on September 5, 2012, and $0.1 million (=$2.5 million - $2.4 million) on March 5, 2013.

# CHAPTER SEVEN
## OPTION MARKETS AND CONTRACTS

**An option**; -is a financial derivative contract that provides a party the right to buy or sell an underlying at a fixed price by a certain time in the future. The part buying the right is called the option buyer while the party granting the right is called option seller. There are 2 types of option. A call and a put option

Call option is an option granting the right to buy the underlying while a put option is an option of granting the right to sell the underlying.
With the exception of some advanced type of option, an option contract is either a call or a put but not both.

Basic characteristics of option

1. The fixed price at which the option holder can buy or sell the underlying is called the exercise price/strike price /striking price/ strike price k
2. The use of this right to buy or sell the underlying is referred to as exercise or exercising the option.
3. An option has an expiration date giving rise to the notion of the options time to expiration. T -t
4. When the expiration date arrives, an option that is not exercised simply expires. If the buyer is exercising a call he/she pays the exercise price and receives either the underlying on an equivalent cash settlement while on the opposite side the seller who receives the exercise price from the buyer delivers the underlying or pays equivalent cash settlement.
5. If the buyer is exercising a put, he/she delivers a stock and receives the exercise price or an equivalent cash settlement .the seller on the other hand receives the underlying and must pay the exercise price or equivalent cash settlement. In cash settlement, the option holder exercising a call receives the difference between the market value and the exercise price from the seller in cash. If the option holder exercises a put, he receives the difference between the exercise price and the market value of the underlying in cash. There are 2 primary exercised styles associated with options.

I. European style of exercise
This means that the option can only be exercised on its expiration date

In some cases, expiration could occur during that day in others, exercise can occur only after expiration occurs. In both cases such an option is called a European option

2. American style exercise
This means that the option can be exercised on any day through the expiration day and such an option is called an American option

Options contracts specify a designated number of units of the underlying for exchange.

Is negotiated by the 2 parties. For an OTC, the 2 parties decide each of the 2 turns through negotiation.

OTC are subject to default. When a buyer exercises, the seller of the option must either deliver the stock/cash if a call or pay for the stock/cash if a put . if the writer cannot do so for financial reasons, the option holder faces a credit loss. The seller does not face any credit risk because of the premium which is paid upfront and is not required to do anything else. Credit risk in an option is unilateral since only the buyer faces the credit risk as opposed to forwards.

Principles of option

(i) The higher the exercise price , the lower the call option premium
(ii) The lower the exercise price, the lower the put option premium
(iii) The shorter the time to expiration the cheaper the call and put option.

# CHAPTER EIGHT
# RISK MANAGEMENT OF OPTIONS STRATEGIES

Options have non-linear payoffs and permit their users to benefit from movements in the underlying in one direction and not to be harmed by movements in the other direction in exchange for the premium paid up front.
Holders of the short position can have large losses due to options hence need to be compensated by the premium and must skillfully manage the risk they assume.

Risk management through option strategies can be achieved through 3 major approaches:

1. Equity investing risk management
2. Interest rate risk management
3. Option portfolio risk management

**Assumptions**

1. Most of the options contracts are customized, over the counter options
2. All options are European options – No consideration of terminating option early

## (A)Option strategies for Equity portfolio

### 1. Buy or sell short the underlying

Selling short involves borrowing the shares from a broker, selling them at the current price and then buying them back at a later date hence if you sell short the stock and it goes down, you make a profit and vice versa.

**CALLS**

Call options are purchased by investors who are bullish. For the option buyer:
$C_T = Max(0, S_T - X)$
Therefore $C_T = 0$ if $S_T \leq X$ & $C_T = S_T - X$ if $S_T \geq x$
Value at expiration = $C_T$
Profit: $\pi = C_T - C_0$
$\pi = -C_0$ if $S_T \geq x$ & $\pi = S_T - X - C_0$ if $S_T > x$
Maximum profit = $\infty$

Maximum loss = $C_o$
Breakeven: $S_T^*=X+c_0$

**For the option seller**
$C_T=Max\ (0, S_T - X)$
Value at expiration = $-C_T$ Profit $\pi = C_T+C_O$
Max. profit $C_o$
Max. loss = $\infty$
Break even, $S_T^*= X+Co$
**NB:** Just as there is the upper limit to the buyer's potential gain, there's no upper limit to how much the seller can lose hence call options are purchased by bullish investors.