fraction of a basis point. They are having to develop more electronic skills to survive.

## 11.3 Types of SWAPS

SWAPS are derivative instruments that represent an agreement between two parties to exchange a series of cash flows over a specific period of time. Swaps offer great flexibility

in designing and structuring contracts based on mutual agreement. This flexibility generates many swap variations, with each serving a specific purpose.

There are multiple reasons why parties agree to such an exchange:

Paul borrows at floating (LIBOR+0.5%), but since he prefers fixed, he enters into a swap contract with the bank to pay fixed 10.10% and receive the floating rate.

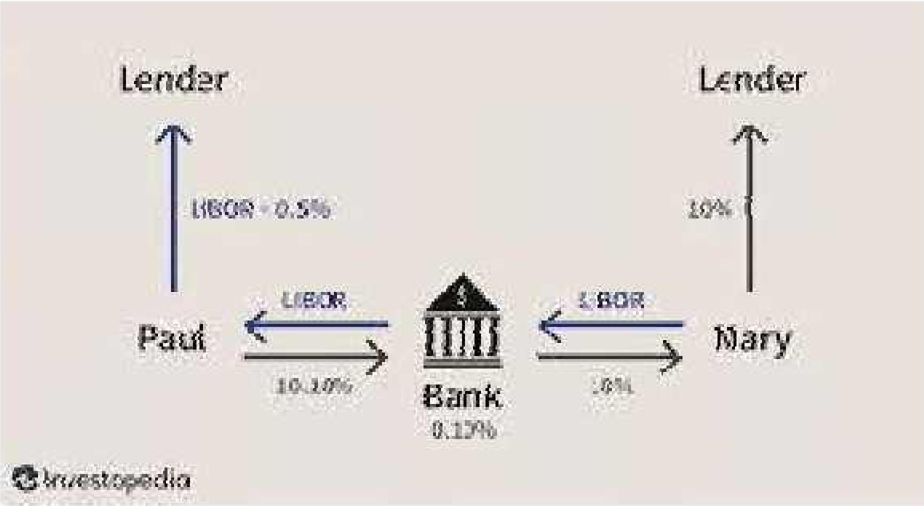



*Fig 11.6: Interest Rate SWAP*

***Benefits:*** Paul pays (LIBOR+0.5%) to the lender and 10.10% to the bank, and receives LIBOR from the bank. His net payment is 10.6% (fixed). The swap effectively converted his original floating payment to a fixed rate, getting him the most economical rate. Similarly, Mary pays 10% to the lender and LIBOR to the bank and receives 10% from the bank. Her net payment is LIBOR (floating). The swap effectively converted her original fixed payment to the desired floating, getting her the most economical rate. The bank takes a cut of 0.10% from what it receives from Paul and pays to Mary.

**(b) Currency Swaps:**

The transactional value of capital that changes hands in currency markets surpasses that of all other markets. Currency swaps offer efficient ways to hedge forex risk.

Assume an Australian company is setting up a business in the UK and needs GBP 10 million. Assuming the AUD/GBP exchange rate at 0.5, the total comes to AUD 20 million. Similarly, a UK-based company wants to set up a plant in Australia and needs AUD 20 million. The cost of a loan in the UK is 10% for foreigners and 6% for locals, while in Australia it's 9% for foreigners and 5% for locals. Apart from the high loan cost for foreign companies, it might be difficult to get the loan easily due to procedural difficulties. Both companies have a competitive advantage in their domestic loan markets. The Australian firm can take a low-cost loan of AUD 20 million in Australia, while the English firm can take a low-cost loan of GBP 10 million in the UK. Assume both loans need six monthly repayments.

Both companies then execute a currency swap agreement. At the start, the Australian firm gives AUD 20 million to the English firm and receives GBP 10 million, enabling both firms to start a business in their respective foreign lands. Every six months, the Australian firm pays the English firm the interest payment for the English loan = (notional GBP amount * interest rate * period) = (10 million * 6% * 0.5) = GBP 300,000 while the English firm pays the Australian firm the interest payment for the Australian loan = (notional AUD amount * interest rate * period) = (20 million * 5% * 0.5) = AUD 500,000. Interest payments continue until the end of the swap agreement, at which time the original notional forex amounts will be exchanged back to each other.

***Benefits:*** By getting into a swap, both firms were able to secure low-cost loans and hedge against interest rate fluctuations. Variations also exist in currency swaps, including fixed vs. floating and floating vs. floating. In sum, parties are able to hedge against volatility in forex rates, secure improved lending rates, and receive foreign capital.

**(c) Commodity Swaps:**

Commodity swaps are common among individuals or companies that use raw materials to produce goods or finished products. Profit from a finished product may suffer if commodity prices vary, as output prices may not change in sync with commodity prices. A commodity swap allows receipt of payment linked to the commodity price against a fixed rate.

Assume two parties get into a commodity swap over one million barrels of crude oil. One party agrees to make six-monthly payments at a fixed price of $60 per barrel and receive the existing (floating) price. The other party will receive the fixed and pay the floating.

If crude oil rises to $62 at the end of six months, the first party will be liable to pay the fixed ($60 *1 million) = $60 million and receive the variable ($62 * 1 million) = $62 million from the second party. Net cash flow in this scenario will be $2 million transferred from the second party to the first. Alternatively, if crude oil drops to $57 in the next six months, the first party will pay $3 million to the second party.

***Benefits:*** The first party has locked in the price of the commodity by using a currency swap, achieving a price hedge. Commodity swaps are effective hedging tools against variations in commodity prices or against variation in spreads between the final product and raw material prices.

**(d) Credit Default Swaps:**

The credit default swap offers insurance in case of default by a third-party borrower. Assume Peter bought a 15-year long bond issued by ABC, Inc. The bond is worth $1,000 and pays annual interest of $50 (i.e., 5% coupon rate). Peter worries that ABC, Inc. may default so he executes a credit default swap contract with Paul. Under the swap agreement, Peter (CDS buyer) agrees to pay $15 per year to Paul (CDS seller). Paul trusts ABC, Inc. and is ready to take the default risk on its behalf. For the $15 receipt per year, Paul will offer insurance to Peter for his investment and returns. If ABC, Inc. defaults, Paul will pay Peter $1,000 plus any remaining interest payments. If ABC, Inc. does not default during the 15-year long bond duration, Paul benefits by keeping the $15 per year without any payables to Peter.

***Benefits:*** The CDS works as insurance to protect lenders and bondholders from borrowers' default risk.

**(e) Zero Coupon Swaps:**

Similar to the interest rate swap, the zero coupon swap offers flexibility to one of the parties in the swap transaction. In a fixed-to-floating zero coupon swap, the fixed rate cash flows are not paid periodically, but just once at the end of the maturity of the swap contract. The other party who pays floating rate keeps making regular periodic payments following the standard swap payment schedule.

A fixed-fixed zero coupon swaps is also available, wherein one party does not make any interim payments, but the other party keeps paying fixed payments as per the schedule.

***Benefits:*** The zero coupon swap (ZCS) is primarily used by businesses to hedge a loan in which interest is paid at maturity or by banks that issue bonds with end-of-maturity interest payments.

**(f) Total Return Swaps:**

A total return swap gives an investor the benefits of owning securities, without actual ownership. A TRS is a contract between a total return payer and total return receiver. The payer usually pays the total return of agreed security to the receiver and receives a fixed/floating rate payment in exchange. The agreed (or referenced) security can be a bond, index, equity, loan, or commodity. The total return will include all generated income and capital appreciation.

Assume Paul (the payer) and Mary (the receiver) enter into a TRS agreement on a bond issued by ABC Inc. If ABC Inc.'s share price rises (capital appreciation) and pays a dividend (income generation) during the swap's duration, Paul will pay Mary those benefits. In return, Mary has to pay Paul a pre-determined fixed/floating rate during the duration.

***Benefits:*** Mary receives a total rate of return (in absolute terms) without owning the security and has the advantage of leverage. She represents a hedge fund or a bank that benefits from the leverage and additional income without owning the security. Paul transfers the credit risk and market risk to Mary, in exchange for a fixed/floating stream of payments. He represents a trader whose long positions can be converted to a short-hedged position while also deferring the loss or gain to the end of swap maturity.

## 11.4 Basic SWAP Structure

As suggested by its origins, the earliest applications of the swap market were to assist in the raising of cheap funds through the comparative advantage concept. It was quickly realized that swaps, especially being off-balance sheet instruments, could also be effective in the management of both currency and interest rate medium-term risk. The commonest example is of a company that is currently paying floating interest, and is concerned about interest rates rising in the future. By entering into an interest rate swap to pay a fixed rate and receive a floating rate, uncertainty has been removed:

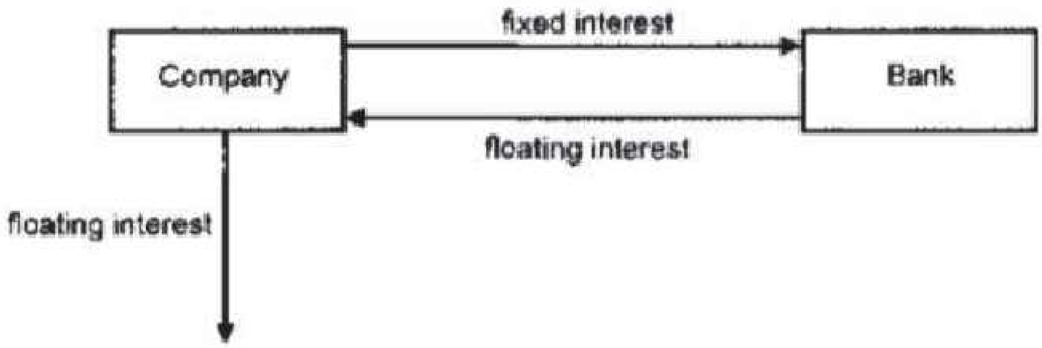
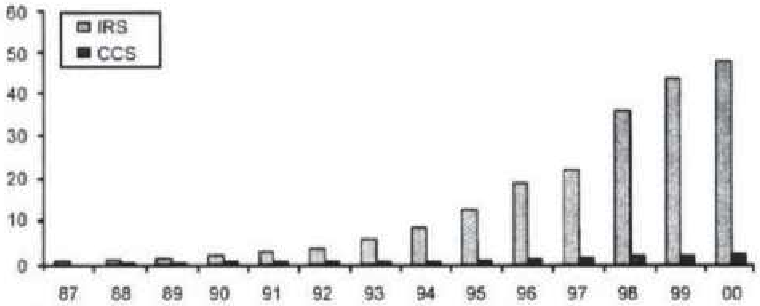



***Fig 11.7: SWAP Structure***

To ensure that the risk management is effective, the floating interest receipts under the swap must exactly match the interest payments under the debt. Therefore the swap must mirror any structural complexities in the debt, such as principal repayment schedules, options to repay early, and so on. Usually a swap entered into between a bank and a customer is tailored specifically for that situation. This book will provide details of many of the techniques used to structure such swaps.

A well-known and very early example of the use of swaps is the one conducted between the World Bank and IBM in August 1981. This swap has the reputation of kick-starting the swap market because it was performed by two extremely prestigious organizations, and received a lot of publicity which attracted many other endusers to come into the market. It was the first long-term swap done by the World Bank, which is now one of the biggest users of the swap market.




*Source:* ISDA. Reproduced by permission of the International Swaps and Derivatives Association.

***Fig 11.8: Size of the swap market (notional principal outstanding $tr)***

## 11.5 Merits of SWAP Market

### 1. Borrowing at Lower Cost:

Swap facilitates borrowings at lower cost. It works on the principle of the theory of comparative cost as propounded by Ricardo. One borrower exchanges the comparative advantage possessed by him with the comparative advantage possessed by the other borrower. The net result is that both the parties are able to get funds at cheaper rates.

### 2. Access to New Financial Markets:

Swap is used to have access to new financial markets for funds by exploring the comparative advantage possessed by the other party in that market. Thus, the comparative advantage possessed by parties is fully exploited through swap. Hence, funds can be obtained from the best possible source at cheaper rates.

### 3. Hedging of Risk:

Swap can also be used to hedge risk. For instance, a company has issued fixed rate bonds. It strongly feels that the interest rate will decline in future due to some changes in the economic scene. So, to get the benefit in future from the fall in interest rate, it has to exchange the fixed rate obligation with floating rate obligation. That is to say, the company has to enter into swap agreement with a counterparty, whereby, it has to receive fixed rate interest and pay floating rate interest. The net result is that the company will have to pay only floating rate of interest. The fixed rate it has to pay is compensated by the fixed rate it receives from the counterparty. Thus, risks due to fluctuations in interest rate can be overcome through swap agreements. Similar, agreements can be entered into for currencies also.

**4. Tool to correct Asset-Liability Mismatch:**

Swap can be profitably used to manage asset-liability mismatch. For example, a bank has acquired a fixed rate bearing asset on the one hand and a floating rate of interest bearing liability on the other hand. In case the interest rate goes up, the bank would be much affected because with the increase in interest rate, the bank has to pay more interest. This is so because, the interest payment is based on the floating rate. But, the interest receipt will not go up, since, the receipt is based on the fixed rate. Now, the asset- liability mismatch emerges. This can be conveniently managed by swap. If the bank feels that the interest rate would go up, it has to simply swap the fixed rate with the floating rate of interest. It means that the bank should find a counterparty who is willing to receive a fixed rate interest in exchange for a floating rate. Now, the receipt of fixed rate of interest by the bank is exactly matched with the payment of fixed rate interest to swap counterparty. Similarly, the receipt of floating rate of interest from the swap counterparty is exactly matched with the payment of floating interest rate on liabilities. Thus, swap is used as a tool to correct any asset- liability mismatch in interest rates in future.

**12. Additional Income:**

By arranging swaps, financial intermediaries can earn additional income in the form of brokerage.

## 11.6 Limitations of SWAP

Swap can be defined as agreement between two parties to exchange a series of payment, the terms of which are predetermined is called swap. In simple terms when one party agree to exchange its financial instrument with other parties financial instrument is called swap. However there are certain limitations of using swap and here are some of them –

10. It is difficult to identify a counter-party to take the opposite side of the transaction. So suppose one company wants to swap $100000 it is not

necessary that other company will also be willing to swap the same amount with same maturity and hence it is a shortcoming of swap market.

11. The swap deal cannot be terminated without the mutual agreement of the parties involved in the transactions, also it has significant amount of default risk in it and hence it is risky instrument to use.

12. Secondary market for swap is still not fully developed like that of equity or currency market and hence swaps are illiquid and cannot be easily traded like equities or currencies.

13. Since swap market is an over the counter market and not exchange controlled the parties have to look carefully into the creditworthiness of the counter-party because there is no exchange to guarantee about fulfilling of the obligations of the parties involved in swap.

## 11.7 Summary

- A swap is a derivative contract between two parties that involves the exchange of pre-agreed cash flows of two financial instruments. The cash flows are usually determined using the notional principal amount (a predetermined nominal value). Each stream of the cash flows is called a —leg.‖

- Corporate finance professionals may use swap contracts to hedge risk and minimize the uncertainty of certain operations. For example, sometimes projects can be exposed to exchange rate risk and the Company's CFO may use a currency swap contract as a hedging instrument.

- Interest Rate SWAP: Counterparties agree to exchange one stream of future interest payments for another, based on a predetermined notional principal amount. Generally, interest rate swaps involve the exchange of a fixed interest rate for a floating interest rate.

- Currency SWAP: Counterparties exchange the principal amount and interest payments denominated in different currencies. These contracts swaps are often used to hedge another investment position against currency exchange rate fluctuations.

- Commodity swaps are common among individuals or companies that use raw materials to produce goods or finished products. Profit from a finished product may suffer if commodity prices vary, as output prices may not change in sync with commodity prices. A commodity swap allows receipt of payment linked to the commodity price against a fixed rate.

- A total return swap gives an investor the benefits of owning securities, without actual ownership. A TRS is a contract between a total return payer and total return receiver.

- The zero coupon swap offers flexibility to one of the parties in the swap transaction. In a fixed-to-floating zero coupon swap, the fixed rate cash flows are not paid periodically, but just once at the end of the maturity of the swap contract.

## 11.8 Self-Assessment Questions

1. Discuss the evolution of SWAP

2. What are the types of SWAP? Explain.

3. Explain the SWAP structure with example.
4. What are the features of SWAP?

5. What are the advantages and disadvantages of SWAP?

## 11.9 Suggested Readings


1. Kolb,R.W. & Overdhal,J.A., Financial Derivatives, John Wiley & Sons, Inc.

2. Kumar, S.S.S., Financial Derivatives, PHI Learning Private Limited.

3. Parasuraman,N.R., Fundamentals of Financial Derivatives, Wiley India Pvt. Ltd.

4. Gupta, S.L., Financial Derivatives, PHI Private Limited.

# UNIT 12: CURRENCY SWAPS

## Unit Objective:



## 12.0 Unit objective

The objective of this unit is to explore Currency SWAPS, its meaning, history, currency SWAP transaction, its valuation with illustrations.

## 12.1 Meaning of Currency SWAPS

A currency swap contract (also known as a cross-currency swap contract) is a derivative contract between two parties that involves the exchange of interest payments, as well as the exchange of principal amounts in certain cases, that are denominated in different currencies. Although currency swap contracts generally imply the exchange of principal amounts, some swaps may require only the transfer of the interest payments.

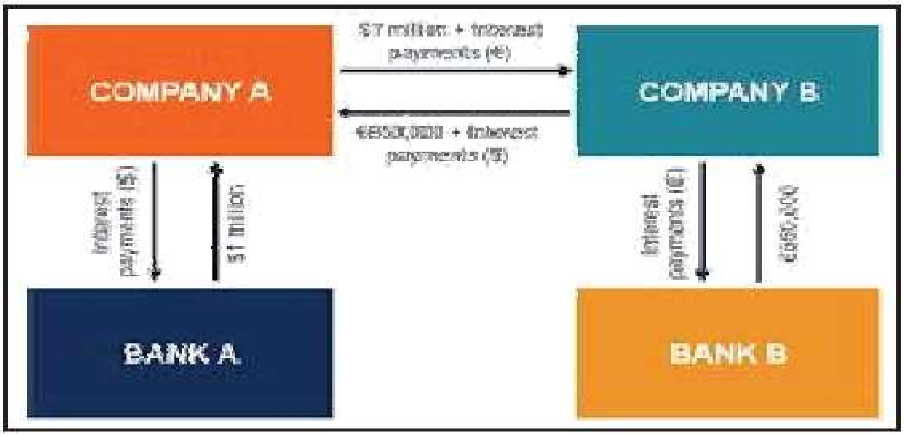



*Fig 12.1: Currency SWAP Contract*

**Breaking Down Currency Swap Contracts**

A currency swap consists of two streams (legs) of fixed or floating interest payments denominated in two currencies. The transfer of interest payments occurs on predetermined dates. In addition, if the swap counterparties previously agreed to exchange principal amounts, those amounts must also be exchanged on the maturity date at the same exchange rate.

Currency swaps are primarily used to hedge potential risks associated with fluctuations in currency exchange rates or to obtain lower interest rates on loans in a foreign currency. The swaps are commonly used by companies that operate in different countries. For example, if a company is conducting business abroad, it would often use currency swaps to retrieve more favourable loan rates in their local currency, as opposed to borrowing money from a foreign bank.

For example, a company may take a loan in the domestic currency and enter a swap contract with a foreign company to obtain a more favourable interest rate on the foreign currency that is otherwise is unavailable.

**How Do Currency Swap Contracts Work?**

In order to understand the mechanism behind currency swap contracts, let's consider the following example. Company A is a US-based company that is planning to expand its operations in Europe. Company A requires €850,000 to finance its European expansion.

On the other hand, Company B is a German company that operates in the United States. Company B wants to acquire a company in the United States to diversify its business. The acquisition deal requires US$1 million in financing.

Neither Company A nor Company B holds enough cash to finance their respective projects. Thus, both companies will seek to obtain the necessary funds through debt financing. Company A and Company B will prefer to borrow in their domestic currencies (that can be borrowed at a lower interest rate) and then enter into the currency swap agreement with each other.

The currency swap between Company A and Company B can be designed in the following manner. Company A obtains a credit line of $1 million from Bank A with a fixed interest rate of 3.5%. At the same time, Company B borrows €850,000 from Bank B with the floating interest rate of 6-month LIBOR. The companies decide to create a swap agreement with each other.

According to the agreement, Company A and Company B must exchange the principal amounts ($1 million and €850,000) at the beginning of the transaction. In addition, the parties must exchange the interest payments semi-annually.

Company A must pay Company B the floating rate interest payments denominated in euros, while Company B will pay Company A the fixed interest rate payments in US dollars. On the maturity date, the companies will exchange back the principal amounts at the same rate ($1 = €0.85).

**Types of Currency Swap Contracts**

Similar to interest rate swaps, currency swaps can be classified based on the types of legs involved in the contract. The most commonly encountered types of currency swaps include the following:

5. **Fixed vs. Float:** One leg of the currency swap represents a stream of fixed interest rate payments while another leg is a stream of floating interest rate payments.

6. **Float vs. Float (Basis Swap):** The float vs. float swap is commonly referred to as basis swap. In a basis swap, both swaps' legs both represent floating interest rate payments.

9. **Fixed vs. Fixed:** Both streams of currency swap contracts involve fixed interest rate payments.

For example, when conducting a currency swap between USD to CAD, a party that decides to pay a fixed interest rate on a CAD loan can exchange that for a fixed or floating interest rate in USD. Another example would be concerning the floating rate. If a party wishes to exchange a floating rate on a CAD loan, they would be able to trade it for a floating or fixed rate in USD as well.

**How a Currency Swap is priced**

Pricing is expressed as a value based on LIBOR +/- spread, which is based on the credit risk between the exchanging parties. LIBOR is considered a benchmark interest rate that major global banks lend to each other in the interbank market for short-term borrowings. The spread stems from the credit risk, which is a premium that is based on the likelihood that the party is capable of paying back the debt that they had borrowed with interest.

## 12.2 History of Currency SWAP between World Bank and IBM

**World Bank-IBM Swap, August 1981**

This is a simplified version of the famous swap. The two counterparties had very different objectives.

**IBM** had embarked upon a world-wide funding programme some years earlier, raising money inter alia in Deutschmarks and Swiss Francs. The money was remitted back to the US for general funding. This had created an FX exposure, because IBM had to convert USDs into DEMs and CHFs regularly to make the coupon payments. Over the years the USD had significantly strengthened, creating a gain for IBM. It now wished to lock in the gain and remove any future exposure.

**The World Bank** had a policy of raising money in hard currency; namely DEM, CHF and Yen. It was a prolific borrower, and by 1981 was finding that its cost of funds in these currencies was rising simply through an excess supply of WB paper. Its objective, as always, was to raise cheap funds.

**Salomon Brothers** suggested the following transactions.

➢ The WB could still raise USD at relatively cheap rates, therefore it should issue two Eurodollar bonds:

- one matched to the principal and maturity of IBM's DEM liabilities equivalent to $210 million;

- the other matched to IBM's Swiss Franc liabilities equivalent to $80 million.

Each bond had a short first period to enable the timing of all future cashflows to match.

(b) There was a two-week settlement period, so WB entered into an FX forward contract to:

□ sell the total bond proceeds of $290 million;

□ buy the equivalent in DEM and Sw Fr.

(d) IBM and WB entered into a two-stage swap whereby:

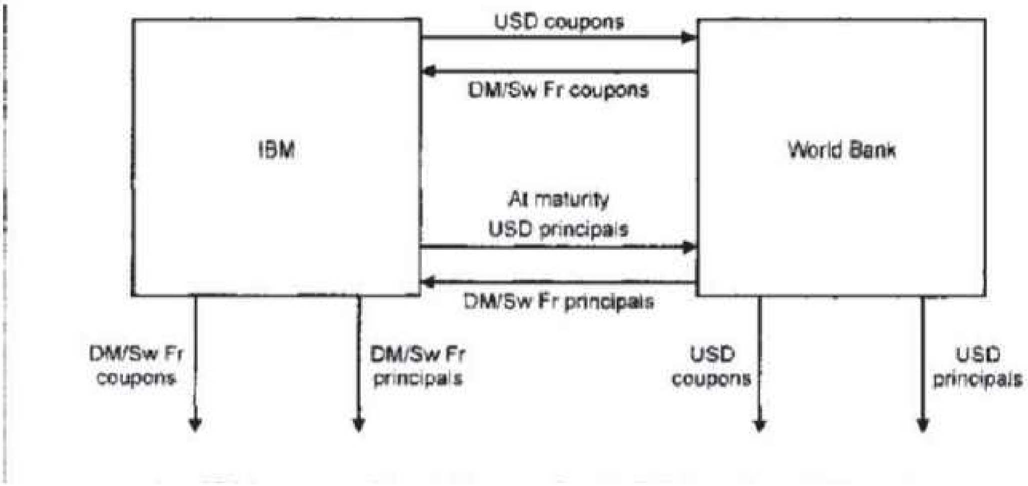



***Fig 12.2: IBM and WB entering into Two Stage SWAP***

So that IBM converted its DEM and Sw Fr liabilities into USD, and the WB effectively raised hard currencies at a cheap rate. Both achieved their objectives.

## 12.3 Currency SWAP Transaction

A currency swap is a legal agreement between two parties to exchange the principal and interest rate obligations, or receipts, in different currencies.

The transaction involves two counter-parties who exchange specific amounts of two currencies at the outset, and repay them over time according to a predetermined rule that reflects both the interest payment and the amortisation of the principal amount.

A currency swap is an agreement to exchange fixed or floating rate payments in one currency for fixed or floating payments in a second currency plus an exchange of the principal currency amounts.

Currency swap allows a customer to re-denominate a loan from one currency to another. The re-denomination from one currency to another currency is done to lower the borrowing cost for debt and to hedge exchange risk. The concept behind is to match the difference between the spot and forward rate of any currency over a specified period of time.

Usually, banks with a global presence act as intermediaries in swap transactions, helping to being together the two parties. Sometimes, banks themselves may become counter-parties to the swap deal, and try to offset the risk they take by entering into an offsetting swap deal. Alternatively, banks can hedge themselves by taking positions in the futures markets.

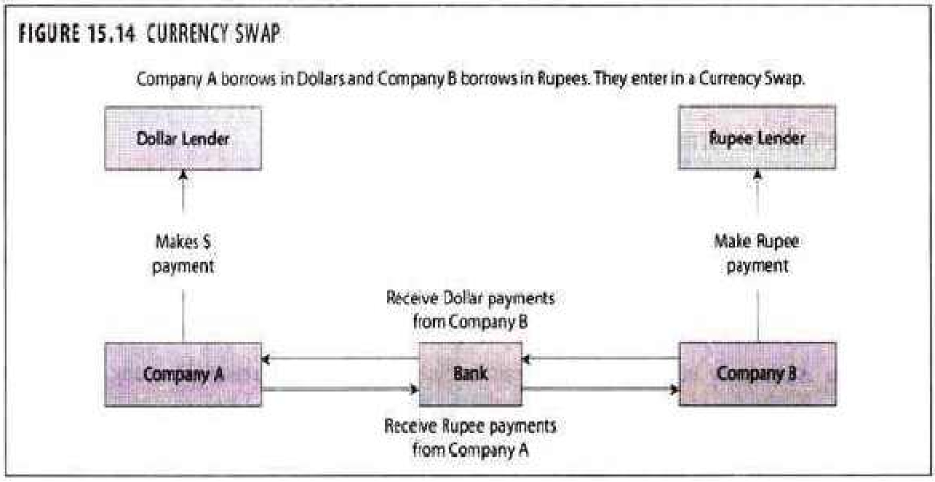



*Fig 12.3: Currency SWAP*

## Illustrations:

### Illustration 1:

A U.S. based company intends to give loan of 5 million dollars to its counter-part in Germany for 8 years. On the other hand and at the same time, a German Company wishes to lend money to its U.S. based sister concern an amount of 5 million dollars for a period of 8 years.

Here, in both the cases, the intermediary Bank is same which might bring the two companies together in a parallel loan arrangement as follows:

(i) U.S. based Company can extend loan of 5 million dollars for a period of 8 years to the German Company's sister concern based in U.S.

(ii) Simultaneously, the German company can lend 5 million dollars for a period of 8 years to U.S. based company's counterpart in Germany in Euro.

The parallel loan was the antecedent to currency swap.

### Illustration 2:

A retail investor in Europe is prepared to invest in a well-known U.S. Company making it cheaper for such a borrower to raise debt in Europe than in the U.S. domestic markets. Tax or other regulatory restrictions may also entice borrowers into a currency, which can then be swapped into the currency originally desired. Currency swaps are usually used in subsidized export financing and also used to diversify exchange exposures. Available at one time arrangement fee paid upfront it helps a company to reduce overall exposure as well as reduce borrowing cost.

**Illustration 3:**

A Company Forex portfolio comprises of a major weightage to Pound against which the rupee has fallen heavily right through them the company may swap to say Japanese Yen a part of its exposure and at the end of the period repay principal in Pounds. Overall economies may be available to a company in the form of reduced interest payment on the Japanese Yen vis-a-vis the Pounds.

Thus lower borrowing cost can be achieved versus borrowing the currency directly and to spread out exchange exposure by swapping to a basket of currencies. Currency swaps are usually used in subsidized export financing and also used to diversify exchange exposures.

Available at one time arrangement fee paid up-front, it helps a company to reduce overall exposure as well as reduce borrowing cost.

## 12.4 Valuation of Currency SWAPS

Currency swaps are an extension of IRS where the difference is that the interest rate legs are in different currencies. When exchanging two currencies on the market for immediate delivery the spot exchange rate, $S_0$ is defined as:

$$S_0 = \frac{\text{units of the domestic currency}}{\text{unit of the foreign currency}} = \frac{N_d}{N_f}.$$

There are two widely used currency derivatives, foreign exchange swap (FX swap) and cross currency basis swap (CCY swap). The FX swap is a short term instrument (usually 3 months), and the CCY swap is a long term instrument (> 3 months)

### 12.4.1 FX swaps

The FX swap is a short term derivative where the parties swap notional in the two currencies at the issue date at the spot exchange rate, S0, and at maturity

the parties swap back the notional according to the forward exchange rate, f0, which was agreed up on at the issue date. There are no interest rate payments between the parties in a FX swap. The notional amounts in the two currencies must satisfy, Nd = S0 - Nf, where Nd is the domestic notional, and Nf is the foreign notional. This relation of the notional amounts is used for the future exchange of notional. The forward exchange rate f0 is based on the assumption of no arbitrage where the following relation must hold:

$$-S_0 \cdot (1 + rd)^T + f_0 \cdot (1 + rf)^T = 0, \qquad (1)$$

Where, $r_d$ is the domestic default free spot rate, rf is the foreign default free spot rate, and T is the time horizon for the forward exchange price. The forward exchange rate is then defined as:

$$f_0 = S_0 \cdot \frac{(1 + r_d)^T}{(1 + r_f)^T}. \qquad (2)$$

This relation is often referred to as the classic interest rate parity, it is assumed that there is no counterparty default risk in forward or swap contracts.

In Figure 12.4 a schematic view of the cash flows between two parties engaged in a FX swap is presented. Let $t_0$ and T be the maturity date, N is the cash flow where the subscript d and f denotes domestic and foreign actions respectively. The future cash flow is determined by the forward exchange rate f0.

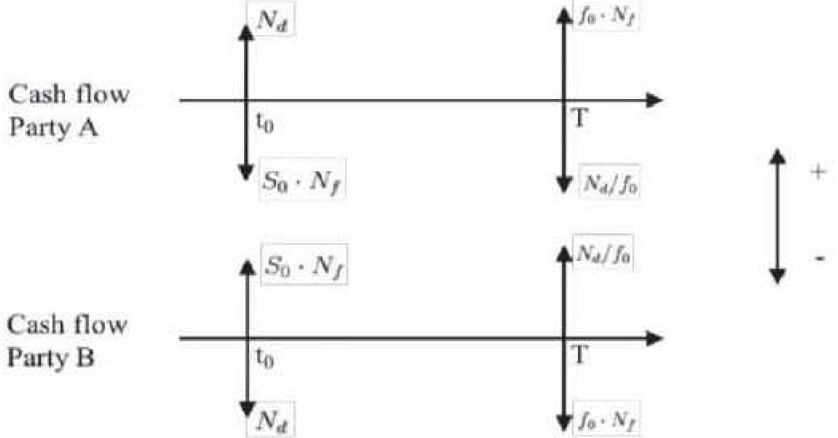


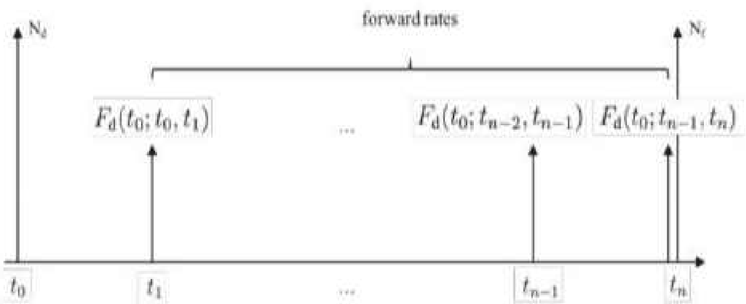
*Fig 12.4: Illustration of the cash flows between two parties in a FX swap.*

Since the Global Financial Crisis 2007-2009 there are evidence that the interest rate parity has failed to hold. In order to preserve the no arbitrage opportunity one leg is adjusted by adding a basis spread. In Equation (3) the basis spread is added on the foreign leg, hence assuming that the domestic leg is the liquidity benchmark. The basis spread is normally added on the leg which is not the liquidity benchmark, where the basis spread can be viewed as the difference between the two underlying interest rate curves

$$f_0 = S_0 \cdot \frac{(1 + r_d)^T}{(1 + r_f + \gamma)^T}. \qquad (3)$$

### 12.4.2 Cross currency swaps

Cross currency swaps were developed from back-to-back loans in the late 1970s. The cross currency swap is similar to the FX swap with the exception that interest payments are exchanged during the life of the contract. The interest rates are determined by either a fixed or floating rate (e.g. LIBOR, STIBOR depending on currency). Hence the interest rate curve is of great importance in the valuation process. There are several possible types of interest flows in a cross-currency swap: floating versus floating, floating versus fixed, and fixed versus fixed, where the first one is of great interest and is called basis swap. The others can be derived synthetically by combining a basis swap with an IRS. The CCY swap can be seen as an exchange of two floating rate bonds one in the domestic currency with notional Nd and one in a foreign currency with notional Nf. In Figure 12.5 you can find a time line depicting the cash flows of a cross currency basis swap.




(4)

***Fig 12.5:*** *Time line describing interest rate cash flows for the payer of foreign currency, i.e. receiver of domestic currency, where the floating coupon received is the forward rate $F_d$. At $t_0$ there is an exchange of notional between the two parties in the swap.*

From Section 12.4.1 we know that the two notional amounts are linked, Nd = S0 -Nf and the CCY swap is fair at inception if this is true. Fair in the meaning that each leg is priced at par. In theory this is true, nevertheless, market quoted CCY swaps are fair if a spread is added to one of the legs in the swap, a result of Equation (3). This spread is called cross currency basis spread .This spread is added since the market charge a liquidity premium on one currency over the other for the transfer of assets/liabilities from one currency to another.

**12.4.3 Simple valuation**

Viewing the CCY swap as two floating rate bonds where the cash flow are made in two currencies, the forward rate is calculated for both currencies, hence the subscript x is introduced, which is substituted for d, domestic or f, foreign. The forward rate is calculated according to Equation (2).

$$F_x(t;t_{i-1},t_i) = \frac{DF_x(t;t_{i-1}) - DF_x(t;t_i)}{\delta_i \cdot DF_x(t;t_i)}, \quad t \le t_{i-1} < t_i. \tag{5}$$

Where, the discount factors DFx(t; ti) are calculated based on the prevailing risk free rate at ti observed on the market at t, and _i is the year fraction between ti-1 and ti. The value at time t, where t > t0, for a payer of domestic currency is

$$\begin{aligned} V_{CCY}(t) = &-S_t \cdot N_f \left( \sum_{i=1}^{n} \delta_i \cdot F_f(t;t_{i-1},t_i) \cdot DF_f(t;t_i) - DF_f(t;t_n) \right) \\ &+ N_d \left( \sum_{i=1}^{n} \delta_i \cdot F_d(t;t_{i-1},t_i) \cdot DF_d(t;t_i) - DF_d(t;t_n) \right). \end{aligned} \tag{6}$$

Since a CCY swap is the exchange of two floating rate bonds, each leg should have a value of Nx, at the beginning of each interest rate period, where Nx are linked by St. In a perfect world, this valuation holds. In practice, the market quotes the basis spread on top of the leg which is not the currency benchmark, hence Equation (4) is just a theoretical valuation. This implies that there exists an arbitrage opportunity and it is necessary to incorporate the basis spread in the valuation. In Section 12.4.4 the basis spread is included in the valuation.

### 12.4.4 Valuation based on a modified discount curve

$$DF^{*}_{x}(t;t_n) = \frac{1 - \sum_{i=1}^{n-1} \delta_i (F_x(t;t_{i-1},t_i) + \gamma_n) DF^{*}_{x}(t;t_i)}{1 + \delta_n \cdot (F_x(t;t_{i-1},t_i) + \gamma_n)}, \quad n = 1,\dots \tag{7}$$

This approach of valuing cross currency swaps was popular before the Global Financial Crisis 2007-2009, nevertheless it is inconsistent with the standard IR S (single currency swap). Two discount factors are utilised in this approach, one for the construction of forward rates and the other for discounting final cash flows. The forward rates, Fx(t; ti 1; ti), are calculated and the discount factors, DFx(t; ti) are calculated based on the prevailing risk free rate at ti observed on the market at t. The leg which is the currency benchmark is valued.) Since no liquidity adjustment is required. For currencies different from the liquidity benchmark, the basis spread n is included. The basis spread is in fact a basis spread curve with several tenors, hence n is not equal for all future cash flows in the swap. Let DFs x be the discount factor exclusively used for discounting cash flows where the defining condition at initiation is

$$1 = \sum_{i=1}^{n} \delta_i (F_x(t;t_{i-1},t_i) + \gamma_n) DF^{s}_{x}(t;t_i) + DF^{s}_{x}(t;t_n), \quad n = 1,\dots \tag{8}$$

Recall that if a swap is valued at par one can derive unknown discount factors using a bootstrapping procedure. The defining condition in Equation (2.5.5) with the exception that the cash flow and the basis spread is included in the formula. Since DFs x(t; ti) is unknown, a recursive bootstrapping formula derived from the defining conditions above is used

Where, the discount factor DFs x is to assure that this leg is at par at inception, and at the

beginning of each coupon period.

The value at time t using this methodology is similar to Expression (4) with the exception that the spread n is added,

$$V_{\mathrm{CCY}}(t) = -S_t \cdot N_{\mathrm{f}} \left( \sum_{i=1}^{n} \delta_i \cdot (F_{\mathrm{f}}(t; t_{i-1}, t_i) + \gamma_n) \cdot DF^{s}{}_{\mathrm{f}}(t; t_i) - DF^{s}{}_{\mathrm{f}}(t; t_n) \right) \tag{9}$$
$$+ N_{\mathrm{d}} \left( \sum_{i=1}^{n} \delta_i \cdot F_{\mathrm{d}}(t; t_{i-1}, t_i) \cdot DF_{\mathrm{d}}(t; t_i) - DF_{\mathrm{d}}(t; t_n) \right)$$

For the leg which is the currency benchmark (in this case the domestic leg), the discount factor DF is used, whereas for the leg to which the spread is added the cash flows are discounted by DFs.

**Test Your Understanding:**

***Explain how you would value a swap that is the exchange of a floating rate in one currency for a fixed rate in another currency.***

## 12.5 Summary

1. A currency swap is an agreement in which two parties exchange the principal amount of a loan and the interest in one currency for the principal and interest in another currency.

2. Four types of currency swaps exist:

   - Pay one currency at a fixed rate, receive another currency fixed rate.

   - Pay one currency at a fixed rate, receive another currency at a floating rate.

- Pay one currency at a floating rate, receive another currency at a fixed rate.

  Pay one currency at a floating rate, receive another currency at a floating rate.

3. A currency swap will have some (not all) similarities to an interest rate swap:

   a. Value is zero at initiation.

- For currency swap types 1-3, a fixed rate must be priced that so the present values to each party are equal.

  Regarding type 4, since both rates are floating, a fixed rate does not need to be found.

4. Currency Swap Differences to Interest Rate Swaps

   For currency swaps, an interest rate must be priced for each currency.

   Each side of the currency swap has its own notional principal in its own currency. Therefore, if one side of the swap has a notional set to 1, then the notional for the other party will be 1/exchange rate.

5. For currency swap type 1 (fixed-fixed), the rate on the domestic side is the fixed rate on a plain vanilla interest rate swap in the home country. The rate on the foreign side is the fixed rate on a plain vanilla interest rate swap in the foreign country.

6. For swap types 2 and 3, (fixed-floating, floating-fixed), the fixed rate sides are determined by the fixed rate on a local swap and the floating rate will be based on the local short term rates.

7. For swap type 4 (floating-floating), the floating rates are based on local market floating rates.

8. Given the incremental complexity of pricing currency swaps over pricing interest rate swaps, candidates are encouraged to obtain proficiency in successfully pricing plain vanilla interest rate swaps before pricing currency swaps.

9. Valuing Currency Swaps

- The same approach to valuing interest rate swaps applies to valuing currency swaps, with the additional complexity of moving exchange rates. This will make calculating the present values to each swap party a little more complicated.

## 12.6 Self-Assessment Questions

1. Discuss the basic motivations for a counterparty to enter into a currency swap.

2. How does the theory of comparative advantage relate to the currency swap market?

3. Discuss the risks confronting an interest rate and currency swap dealer.

4. Briefly discuss some variants of the basic currency swaps diagramed in the chapter.

5. Suppose Morgan Guaranty, Ltd. is quoting swap rates as follows: 7.75 - 8.10 percent annually against six-month dollar LIBOR for dollars and 11.25 - 11.65 percent annually against six-month dollar LIBOR for British pound sterling. At what rates will Morgan Guaranty enter into a $/£ currency swap?

## 12.7 Suggested Readings


1. Kolb,R.W. & Overdhal,J.A., Financial Derivatives, John Wiley & Sons, Inc.

2. Kumar, S.S.S., Financial Derivatives, PHI Learning Private Limited.

3. Parasuraman,N.R., Fundamentals of Financial Derivatives, Wiley India Pvt. Ltd.

4. Gupta, S.L., Financial Derivatives, PHI Private Limited.

# UNIT 13: INTEREST RATE SWAPS

**Unit Structure:**



## 13.0 Unit Objectives

The present unit explains Interest Rate SWAPS, its meaning, SWAP transaction and Valuation of Interest Rate SWAPS.

## 13.1 Meaning of Interest Rate SWAP

An interest rate swap is a forward contract in which one stream of future interest payments is exchanged for another based on a specified principal amount. Interest rate swaps usually involve the exchange of a fixed interest rate for a floating rate, or vice versa, to reduce or increase exposure to fluctuations in interest rates or to obtain a marginally lower interest rate than would have been possible without the swap. A swap can also involve the exchange of one type of floating rate for another, which is called a basis swap.

Interest rate swaps are the exchange of one set of cash flows for another. Because they trade over-the-counter (OTC), the contracts are between two or more parties according to their desired specifications and can be customized in many different ways. Swaps are often utilized if a company can borrow money easily at one type of interest rate but prefers a different type.

An ***interest rate swap*** is an agreement between two parties in which each party makes periodic interest payments to the other party based on a specified principal amount. One party pays interest on a variable rate while the other party pays interest on a fixed rate.

The fixed interest rate is known as the ***swap rate.*** We will use the symbol R to represent the swap rate. The swap rate will be determined at the start of the swap and will remain constant for each payment. In contrast, while the variable interest rate will be defined at the start of the swap (e.g., equal to LIBOR plus 100 bps), the rate will likely change each time a payment is determined.

The two parties in the agreement are known as ***counterparties.*** The counterparty who agrees to pay the swap rate is called the ***payer.*** The counterparty who agrees to pay the variable rate, and thus receive the swap rate, is called the ***receiver.***

The specified principal amount is called the ***notional principal amount*** or just ***notional amount.*** The word —notionall means in name only. The notional principal amount under an interest rate swap is never paid by either counterparty. Thereby, it is principal in name only. However, the notional amount is the basis upon which the exchange of payments is determined. One counter party will owe a payment determined by multiplying the swap rate by the notional amount. The other counterparty will owe a payment determined by multiplying the variable interest rate by the notional amount.

The specified period of the swap is known as the ***swap term*** or ***swap tenor.***

## 13.2 Interest Rate SWAP Transaction

Generally, the two parties in an interest rate swap are trading a fixed-rate and variable-interest rate. For example, one company may have a bond that pays the London Interbank Offered Rate (LIBOR), while the other party holds a bond that provides a fixed payment of 5%. If the LIBOR is expected to stay around 3%, then the contract would likely explain that the party paying the varying interest rate will pay LIBOR plus 2%. That way both parties can expect to receive similar payments. The primary investment is never traded, but the parties will agree on a base value (perhaps $1 million) to use to calculate the cash flows that they'll exchange.

The theory is that one party gets to hedge the risk associated with their security offering a floating interest rate, while the other can take advantage of the potential reward while holding a more conservative asset. It's a win-win situation, but it's also a zero-sum game. The gain one party receives through the swap will be equal to the loss of the other party. While you're neutralizing your risk, in a way, one of you is going to lose some money.

Interest rate swaps are traded over the counter, and if your company decides to exchange interest rates, you and the other party will need to agree on two main issues:

5. **Length of the swap**. Establish a start date and a maturity date for the swap, and know that both parties will be bound to all of the terms of the agreement until the contract expires.

6. **Terms of the swap**. Be clear about the terms under which you're exchanging interest rates. You'll need to carefully weigh the required frequency of payments (annually, quarterly, or monthly). Also decide on the structure of the payments: whether you'll use an amortizing plan, bullet structure, or zero-coupon method.

To illustrate how a swap may work, let's look further into an example.

**Illustration:**

ABC Company and XYZ Company enter into one-year interest rate swap with a nominal value of $1 million. ABC offers XYZ a fixed annual rate of 5% in exchange for a rate of LIBOR plus 1%, since both parties believe that LIBOR will be roughly 4%. At the end of the year, ABC will pay XYZ $50,000 (5% of $1 million). If the LIBOR rate is trading at 4.75%, XYZ then will have to pay ABC Company $57,500 (5.75% of $1 million, because of the agreement to pay LIBOR plus 1%).

Therefore, the value of the swap to ABC and XYZ is the difference between what they receive and spend. Since LIBOR ended up higher than both companies thought, ABC won out with a gain of $7,500, while XYZ realizes a loss of $7,500. Generally, only the net payment will be made. When XYZ pays $7,500 to ABC, both companies avoid the cost and complexities of each company paying the full $50,000 and $57,500.

**13.2.1 Pros: Why Interest Rate Swaps Are Useful**

There are two reasons why companies may want to engage in interest rate swaps:

5. **Commercial motivations**. Some companies are in businesses with specific financing requirements, and interest rate swaps can help managers meet their goals. Two common types of businesses that benefit from interest rate swaps are:

    - **Banks**, which need to have their revenue streams match their liabilities. For example, if a bank is paying a floating rate on its liabilities but receives a fixed payment on the loans it paid out, it may face significant risks if the floating rate liabilities increase significantly. As a result, the bank may choose to hedge against this risk by swapping the fixed payments it receives from their loans for a floating rate payment that is higher than the floating rate payment it needs to pay out. Effectively, this bank will have guaranteed that its revenue will be greater than it expenses and therefore will not find itself in a cash flow crunch.

1. **Hedge funds**, which rely on speculation and can cut some risk without losing too much potential reward. More specifically, a speculative hedge fund with an expertise in forecasting future interest rates may be able to make huge profits by engaging in high-volume, high-rate swaps.

- **Comparative advantages**: Companies can sometimes receive either a fixed- or floating-rate loan at a better rate than most other borrowers. However, that may not be the kind of financing they are looking for in a particular situation. A company may, for example, have access to a loan with a 5% rate when the current rate is about 6%. But they may need a loan that charges a floating rate payment. If another company, meanwhile, can gain from receiving a floating rate interest loan, but is required to take a loan that obligates them to make fixed payments, then two companies could conduct a swap, where they would both be able to fulfill their respective preferences.

In short, the swap lets banks, investment funds, and companies capitalize on a wide range of loan types without breaking rules and requirements about their assets and liabilities.

### 13.2.2 Cons: Risks Associated with Interest Rate Swaps

Swaps can help make financing more efficient and allow companies to employ more creative investing strategies, but they are not without their risks. There are two risk types associated with swaps:

6. **Floating interest rates are very unpredictable and create significant risk for both parties.** One party is almost always going to come out ahead in a swap, and the other will lose money. The party that is obligated to making floating rate payments will profit when the variable rate decreases, but lose when the rate goes up. The opposite effect takes place with the other party.

7. **Counterparty risk adds an additional level of complication to the equation.** Usually this risk is fairly low, since institutions making these trades are usually in strong financial positions, and parties are unlikely to agree to a contract with an unreliable company. But if one party ends up

in default, then they won't be able to make their payments. The resulting legal logistics for recovering the money owed is costly and will cut into the would-be gains.

## 13.3 Valuation of Interest Rate SWAP

Basically, interest rate swaps occur when two parties – one of which is receiving fixed-rate interest payments and the other of which is receiving floating-rate payments – mutually agree that they would prefer the other party's loan arrangement over their own. The party being paid based on a floating rate decides that they would prefer to have a guaranteed fixed rate, while the party that is receiving fixed-rate payments believes that interest rates may rise, and to take advantage of that situation if it occurs – to earn higher interest payments – they would prefer to have a floating rate, one that will rise if and when there is a general uptrend in interest rates.

In an interest rate swap, the only things that actually get swapped are the interest payments. An interest rate swap, as previously noted, is a derivative contract. The parties do not take ownership of the other party's debt. Instead, they merely make a contract to pay each other the *difference* in loan payments as specified in the contract. They do not exchange debt assets, nor pay the full amount of interest due on each interest payment date – only the difference due as a result of the swap contract.

A good interest rate swap contract clearly states the terms of the agreement, including the respective interest rates each party is to be paid by the other party, and the payment schedule (e.g., monthly, quarterly, or annually). In addition, the contract states both the start date and maturity date of the swap agreement, and that both parties are bound by the terms of the agreement until the maturity date.

Note that while both parties to an interest rate swap get what they want – one party gets the risk protection of a fixed rate, while the other gets the exposure to potential profit from a floating rate – ultimately, one party will reap a financial reward while the other sustains a financial loss. If interest rates rise during the term of the swap agreement, then the party receiving the floating rate will profit and the party receiving the fixed rate will incur a loss. Conversely, if interest rates decline, then the party getting paid the guaranteed fixed rate return will benefit, while the party receiving payments based on a floating rate will see the amount of the interest payments it receives go down.

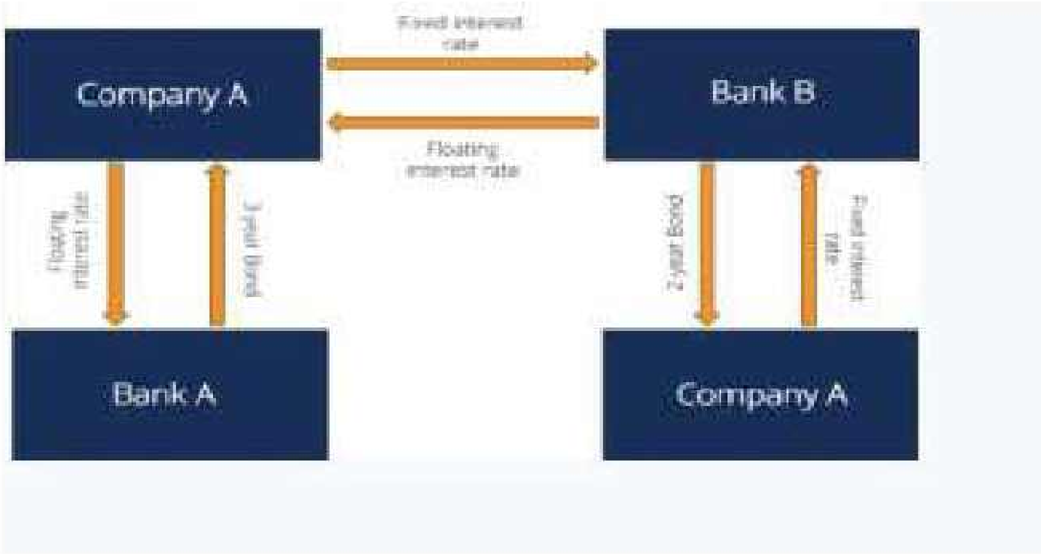



*Fig 13.1: Working of interest Rate SWAP*

**How Is the Fixed Rate Determined?**

The value of the swap at the initiation date will be zero to both parties. For this statement to be true, the values of the cash flow streams that the swap parties are going to exchange should be equal. This concept is illustrated with a hypothetical example in which the value of the fixed leg and floating leg of the swap will be $V_{fix}$ and $V_{fl}$ respectively. Thus, at initiation:

V_{fix} = V_{fl} $V_{fix}=V_{fl}$

Notional amounts are not exchanged in interest rate swaps because these amounts are equal; it does not make sense to exchange them. If it is assumed that parties also decide to exchange the notional amount at the end of the period, the process will be similar to an exchange of a fixed rate bond to a floating rate bond with the same notional amount. Therefore, such swap contracts can be valued in terms of fixed-rate and floating-rate bonds.

For example, suppose that Apple Inc. decides to enter a one-year, fixed-rate receiver swap contract with quarterly installments on a notional amount of $2.5 billion. Goldman Sachs is the counterparty for this transaction that provides fixed cash flows that determine the fixed rate. Assume the LIBOR rates (in dollars) are as follows:

| USD Libor Rates | As of 01.10.2014 (%) |
|---|---|
| Libor 3 month | 0.233% |
| Libor 6 month | 0.325% |
| Libor 9 month | 0.451% |
| Libor 12 month | 0.578% |

Investopedia

Let's denote the annual fixed rate of the swap by *c*, the annual fixed amount by *C*, and the notional amount by *N*.

Thus, the investment bank should pay *c/4*N* or C/4 each quarter and will receive the LIBOR rate multiplied by N. *c* is a rate that equates the value of the fixed cash flow stream to the value of the floating cash flow stream. This is the same as saying that the value of a fixed-rate bond with the coupon rate of *c* must be equal to the value of the floating rate bond.

\begin{aligned} &\beta_fl = \frac{c/q}{(1 + \frac{libor_{3m}}{360} \times 90)} + \frac{c/q}{(1 + \frac{libor_{6m}}{360} \times 180)} + \frac{c/4}{(1 +

\frac{libor_{9m}}{360} \times 270)} + \frac{c/4 + \beta_{fix}}{(1 + \frac{libor_{12m}}{360} \times 360)} \\ &\textbf{where:}\\ &\beta_{fix}=\text{the notional value of the fixed rate bond that is equal to the notional amount of the swap—\$2.5 billion}\\ \end{aligned}*βfl*=(1+360*libor*3*m*×90)*c*/*q*+(1+360*libor*6*m*×180)*c*/*q*+(1+360*libor*9*m*×270)*c*/4 +(1+360*libor*12*m*×360)*c*/4+*βfix*

**where:**

*βfix*=the notional value of the fixed rate bond that is equal to the notional amount of the swap —$2.5 billion

Recall that at the issue date—and immediately after each coupon payment—the value of the floating rate bonds equals the nominal amount. That is why the right-hand side of the equation is equal to the notional amount of the swap.

We can rewrite the equation as:

\beta_{fl} = \frac{c}{4} \times \left( \frac{1}{(1 + \frac{libor_{3m}}{360} \times 90)} + \frac{1}{(1 + \frac{libor_{6m}}{360} \times 180)} + \frac{1}{(1 + \frac{libor_{9m}}{360} \times 270)} + \frac{1}{(1 + \frac{libor_{12m}}{360} \times 360)}\right) + \frac{\beta_{fix}}{(1 + \frac{libor_{12m}}{360} \times 360)}

*Bfl*=4*c*×((1+360*libor*3*m*×90)1+(1+360*libor*6*m*×180)1+(1+360 *libor*9*m*×270)1 +(1+360*libor*12*m*×360)1 )+(1+360*libor*12*m*×360)*βfix*

On the left-hand side of the equation discount factors *(DF)* for different maturities are given.

Recall that:

DF = \frac{1}{1 + r}*DF*=1+*r*1

So if we denote $DF_i$ for *i-th* maturity, we will have the following equation:

\beta_{fl} = \frac{c}{q} \times \sum_{i = 1}^n DF_i + DF_n \times \beta_{fix}*βfl*=*qc* ×∑*i*=1*nDFi*+*DFn*×*βfix*

Which can be re-written as:

\begin{aligned} &\frac{c}{q} = \frac{\beta_{fl} - \beta_{fix} \times DF_n}{\sum_i^n DF_i } \\ &\textbf{where:}\\ &q=\text{the frequency of swap payments in a year}\\ \end{aligned} *qc*=∑*inDFiβfl*−*βfix*×*DFn*

**where:***q*=the frequency of swap payments in a year

We know that in interest rate swaps, parties exchange fixed and floating cash flows based on the same notional value. Thus, the final formula to find the fixed rate will be:

\begin{aligned} &c= q \times N \times \frac{1 - DF_n}{\sum_i^n DF_i } \\ &\text{or}\\ &c=

7.\times \frac{1 - DF_n}{\sum_i^n DF_i}\\ \end{aligned}*c*=*q*×*N*×∑*inDFi*1−*DFn*or*c*=*q*×∑*in DFi*1−*DFn*

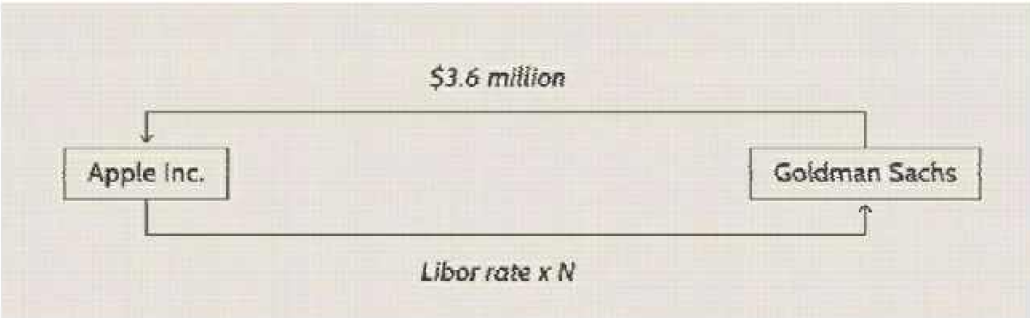
Now let's go back to our observed LIBOR rates and use them to find the fixed rate for this hypothetical interest rate swap.

The following are the discount factors corresponding to the LIBOR rates given:

| USD Libor Rates | As of 01.12.2014 (%) (Hypothetical) | Discount factors (DFs) |
|---|---|---|
| Libor 1 month | 0.333% | 0.99972 |
| Libor 4 month | 0.425% | 0.99859 |
| Libor 7 month | 0.551% | 0.99680 |
| Libor 10 month | 0.678% | 0.99438 |

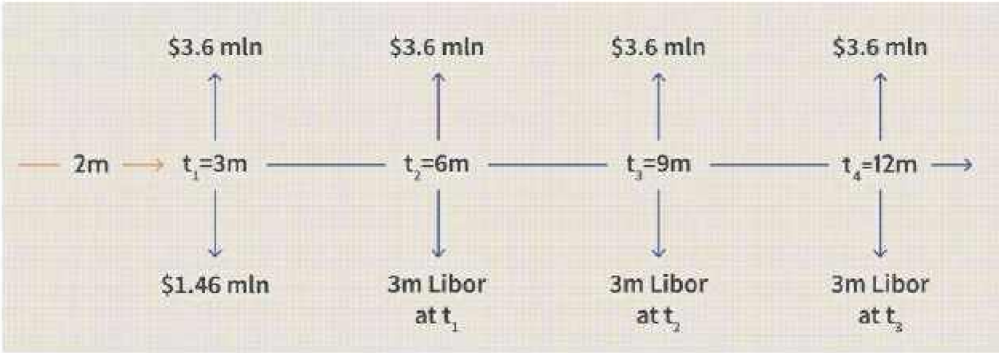
$c = 4 \times (0.99942 + 0.99838 + 0.99663 + 0.99425)(1 - 0.99425) = 0.576\%$

Thus, if Apple wishes to enter into a swap agreement on a notional amount of $2.5 billion in which it seeks to receive the fixed rate and pay the floating rate, the annualized swap rate will be equal to 0.576%. This means that the quarterly fixed swap payment that Apple is going to receive will be equal to $3.6 million (0.576%/4* $2.5 billion).




Now assume that Apple decided to enter the swap on May 1, 2019. The first payments would have been exchanged on August 1, 2019. Based on the swap pricing results, Apple will receive a $3.6 million fixed payment each quarter. Only Apple's first floating payment is known in advance because it's set on the swap initiation date, and it's based on the 3-month LIBOR rate on that day: 0.233%/4* $2.5 billion = $1.46 million.

The next floating amount payable at the end of the second quarter will be determined based on the 3-month LIBOR rate effective at the end of the first quarter. The following figure illustrates the structure of the payments.




Suppose that 60 days had elapsed after this decision. The date is July 1, 2019; there is only one month left until the next payment, and all other payments are now two months closer. What is the value of the swap for Apple on this date? A term structure is needed for one, four, seven, and 10 months. Suppose that the following term structure is given:

| USD Libor Rates | As of 01.12.2014 (%) (Hypothetical) | Discount factors (DFs) |
|---|---|---|
| Libor 1 month | 0.333% | 0.99972 |
| Libor 4 month | 0.425% | 0.99859 |
| Libor 7 month | 0.551% | 0.99680 |
| Libor 10 month | 0.678% | 0.99438 |

It is necessary to revalue the fixed leg and floating leg of the swap contract after the interest rates change, and then compare them in order to find the value for the position. We can do so by re-pricing respective fixed and floating rate bonds.

Thus, the value of fixed rate bond is:

v_{fix} = 3.6 \times (0.99972 + 0.99859 + 0.99680 + 0.99438) + 2500 \times 0.99438 =

\$2500.32 \text{mill.}*vfix* =3.6×(0.99972+0.99859+0.99680+0.99438)+2500×0.99438=$2500.32mill.

And the value of floating rate bond is:

v_{fl} = (1.46 + 2500) \times 0.99972 = \$2500.76 \text{mill.}*vfl* =(1.46+2500)×0.99972=$2500.76mill.

v_{swap} = v_{fix} - v_{fl}*vswap=vfix−vfl*

From Apple's perspective, the value of the swap on July 1, 2019 was $ -0.45 million (the results are rounded). This number is equal to the difference between the fixed rate bond and floating rate bond.

v_{swap} = v_{fix} - v_{fl} = -\$0.45 \text{mill.}*vswap=vfix−vfl=*−$0.45mill.

The swap value was negative for Apple (under these hypothetical circumstances). This makes sense because the decrease in the value of the fixed cash flow is higher than the decrease in the value of the floating cash flow.

**Illustration: An Interest Rate Swap Contract in Action**

Let's see exactly what an interest rate swap agreement might look like and how it plays out in action.

In this example, companies A and B make an interest rate swap agreement with a nominal value of $100,000. Company A believes that interest rates are likely to rise over the next couple of years and aims to obtain exposure to potentially profit from a floating interest rate return that would increase if interest rates do, indeed, rise. Company B is currently receiving a floating interest rate return, but is more pessimistic about the outlook for interest rates, believing it most likely that they will fall over the next two years, which would reduce their interest rate return. Company B is motivated by a desire to secure risk protection against possible declining rates, in the form of getting a fixed rate return locked in for the period.

The two companies enter into a two-year interest rate swap contract with the specified nominal value of $100,000. Company A offers Company B a fixed rate of 5% in exchange for receiving a floating rate of the LIBOR rate plus 1%. The current LIBOR rate at the beginning of the interest rate swap agreement is 4%. Therefore, to start out, the two companies are on equal ground, with both receiving 5%: Company A has the 5% fixed rate, and Company B is getting the LIBOR rate of 4% plus 1% = 5%.

Now assume that interest rates do rise, with the LIBOR rate having increased to 5.25% by the end of the first year of the interest rate swap agreement. Let's further assume that the swap agreement states that interest payments will be made annually (so it is time for each firm to receive its interest payment), and that the floating rate for Company B will be calculated using the prevailing LIBOR rate at the time that interest payments are due.

Company A owes Company B the fixed rate return of $5,000 (5% of $100,000). However, since interest rates have risen, as indicated by the benchmark LIBOR rate having increased to 5.25%, Company B owes Company A $6,250 (5.25% plus 1% = 6.25% of $100,000). To avoid the trouble and expense of both parties paying the full amount due to each other, the swap agreement terms state that only the net difference in payments is to be paid to the appropriate party. In this instance, Company A would receive $1,250 from Company B. Company A has profited from accepting the additional risk inherent with accepting a floating interest rate return.

Company B has suffered a loss of $1,250, but has still gotten what it wanted – protection against a possible interest rate decline. Let's see how things would look if the interest rate market had moved in the opposite direction. What if at the end of the first year of their agreement, the LIBOR rate had fallen to 3.75%? With its fixed rate return, Company B would still be owed $5,000 by Company A. However, Company B would only owe Company A $4,750 (3.75% plus 1% = 4.75%; 4.75% of $100,000 = $4.750). This would be resolved by Company A paying $250 to Company B ($5,000 minus $4,750 = $250). In this scenario, Company A has incurred a small loss and Company B has reaped a benefit.

**Risks of Interest Rate Swaps**

Interest rate swaps are an effective type of derivative that may be of benefit to both parties involved in using them, in a number of different ways. However, swap agreements also come with risks.

One notable risk is that of counterparty risk. Because the parties involved are typically large

companies or financial institutions, counterparty risk is usually relatively low. But if it should

happen that one of the two parties defaults and is unable to meet its obligations under the

interest rate swap agreement, then it would be difficult for the other party to collect. It would

have an enforceable contract, but following the legal process might well be a long and

twisting road.

Just dealing with the unpredictable nature of floating interest rates also adds some inherent

risk for both parties to the agreement.

## 13.4 Summary

1. Interest rate swaps are forward contracts where one stream of future interest payments is exchanged for another based on a specified principal amount.

2. Interest rate swaps can be fixed or floating rate in order to reduce or increase exposure to fluctuations in interest rates.

3. *Fixed-to-Floating:* For example, consider a company named TSI that can issue a bond at a very attractive fixed interest rate to its investors. The company's management feels that it can get a better cash flow from a floating rate. In this case, TSI can enter into a swap with a counterparty bank in which the company receives a fixed rate and pays a floating rate. The swap is structured to match the maturity and cash flow of the fixed-rate bond and the two fixed-rate payment streams are netted. TSI and the bank choose the preferred floating-rate index, which is usually LIBOR for a one-, three-, or six-month maturity. TSI then receives LIBOR plus or minus a spread that reflects both interest rate conditions in the market and its credit rating.

4. *Floating-to-Fixed:* A company that does not have access to a fixed-rate loan may borrow at a floating rate and enter into a swap to achieve a fixed rate. The floating-rate tenor, reset, and payment dates on the loan are mirrored on the swap and netted. The fixed-rate leg of the swap becomes the company's borrowing rate.

5. *Float-to-Float:* Companies sometimes enter into a swap to change the type or tenor of the floating rate index that they pay; this is known as a basis swap. A company can swap from three-month LIBOR to six-month LIBOR, for example, either because the rate is more attractive or it matches other payment flows. A company can also switch to a different index, such as the federal funds rate, commercial paper, or the Treasury bill rate.

**<u>Test Your Understanding:</u>**

Why do banks use interest rate swaps?

## 13.5 Self-Assessment questions

1. What is the purpose of Interest Rate SWAP?

2. What factors affect the SWAP rate?

3. How do you calculate the Interest Rate SWAP?

4. What are the two primary reasons for swapping interest rate?

## 13.6 Suggested Readings


1. Kolb,R.W. & Overdhal,J.A., Financial Derivatives, John Wiley & Sons, Inc.

2. Kumar, S.S.S., Financial Derivatives, PHI Learning Private Limited.

3. Parasuraman,N.R., Fundamentals of Financial Derivatives, Wiley India Pvt. Ltd.

4. Gupta, S.L., Financial Derivatives, PHI Private Limited

# UNIT 14: EQUITY SWAPS

**Unit Structure:**



## 14.0 Unit Objectives

The present unit explains Equity SWAPS, its meaning, SWAP transactions through illustrations.

## 14.1 Meaning

An equity swap is an exchange of future cash flows between two parties that allows each party to diversify its income for a specified period of time while still holding its original assets. An equity swap is similar to an interest rate swap, but rather than one leg being the "fixed" side, it is based on the return of an equity index. The two sets of nominally equal cash flows are exchanged as per the terms of the swap, which may involve an equity-based cash flow (such as from a stock asset called the reference equity) that is traded for fixed-income cash flow (such as a benchmark interest rate).

Swaps trade over-the-counter and are very customizable based on what the two parties agree to. Besides diversification and tax benefits, equity swaps allow large institutions to hedge specific assets or positions in their portfolios.

Equity swaps should not be confused with a debt/equity swap, which is a restructuring transaction in which the obligations or debts of a company or individual are exchanged for equity.

Because equity swaps trade OTC, there is counterparty risk involved.

## 14.2 Equity SWAP Transaction

An equity swap is similar to an interest rate swap, but rather than one leg being the "fixed" side, it is based on the return of an equity index. For example, one party will pay the floating leg (typically linked to LIBOR) and receive the returns on a pre-agreed-upon index of stocks relative to the notional amount of the contract. Equity swaps allow parties to potentially benefit from returns of an equity security or index without the need to own shares, an exchange-traded fund (ETF), or a mutual fund that tracks an index.

Most equity swaps are conducted between large financing firms such as auto financiers, investment banks, and lending institutions. Equity swaps are typically linked to the performance of an equity security or index and include payments linked to fixed rate or floating rate securities. LIBOR rates are a common benchmark for the fixed income portion of equity swaps, which tend to be held at intervals of one year or less, much like commercial paper.

The stream of payments in an equity swap is known as the legs. One leg is the payment stream of the performance of an equity security or equity index (such as the S&P 500) over a specified period, which is based on the specified notional value. The second leg is typically based on the LIBOR, a fixed rate, or another equity's or index's returns.

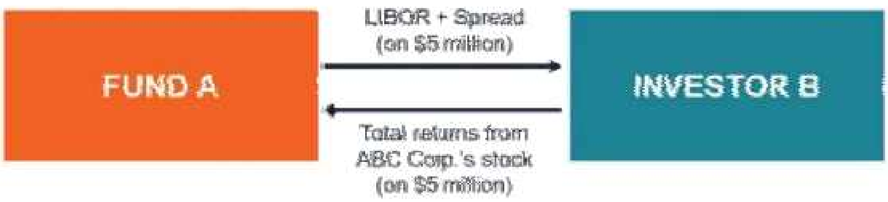



*Fig 14.1: Equity SWAP Contract*

## 14.3 Illustration

### Illustration 14.3.1

Assume a passively managed fund seeks to track the performance of the S&P 500. The asset managers of the fund could enter into an equity swap contract, so it would not have to purchase various securities that track the S&P 500. The firm swaps $25 million at LIBOR plus two basis points with an investment bank that agrees to pay any percentage increase in $25 million invested in the S&P 500 index for one year.

Therefore, in one year, the passively managed fund would owe the interest on $25 million, based on the LIBOR plus two basis points. However, its payment would be offset by $25 million multiplied by the percentage increase in the S&P 500. If the S&P 500 falls over the next year, then the fund would have to pay the investment bank the interest payment and the percentage that the S&P 500 fell multiplied by $25 million. If the S&P 500 rises more than LIBOR plus two basis points, the investment bank owes the passively managed fund the difference.

Since swaps are customizable based on what two parties agree to, there are many potential ways this swap could be restructured. Instead of LIBOR plus two basis points, we could have seen one bp, or instead of the S&P 500, another index could be used.

**Illustration 14.3.2**

In order to understand the functioning of equity swap contracts, let's consider the following example. The manager of Fund A wants to replicate the returns of ABC Corp.'s stock without purchasing the company's actual shares.

On the other hand, Investor B holds a long position in the stocks of ABC Corp. Investor B believes that the company's stock price will be volatile in the short term, thus he wants to hedge the potential risk of the stock price dropping. Fund A and Investor B can create an equity swap contract with each other to achieve their respective goals. The swap will include the exchange of future streams of cash flows.

One leg of the swap will be paid by Fund A to Investor B and will be the stream of floating payments linked to the LIBOR index. The other swap leg will be paid by Investor B to Fund A and will be based on the future total returns of ABC Corp.'s stock for the specified period.

Both legs will be calculated using a notional principal amount. In this case, both parties agree on a notional principal amount of $5,000,000. Note that Fund A and Investor B will not exchange principal amounts at the beginning of the contract nor on the maturity date.

## 14.4 Equity SWAP Valuation

There are two legs in an equity swap: an equity leg and a floating interest leg. The payoff for both legs could be set at every reset date or at maturity; or could be one side at maturity and the other at every reset date. The price of the swap is the difference between the present values of both legs' cash flows. In other words, the present value of swap is net of present value of ―equity legǁ and ―money market legǁ.

**The present value of an equity asset is given by**

$$PV_{asset}(t) = \sum_{i=1}^{n} \left[\frac{S_i - S_{i-1}}{S_{i-1}}\right] N_i D_i$$

where

$t$ – the valuation date

$N_i = \alpha S_{i-1}$ – the notational principal amount

$\alpha$ - shares

$i$ – the $i^{th}$ cash flow from $1$ to $n$

$D_i = D(t, T_i)$ -- the discount factor

$S_i = [S - PV_i(D)]e^{r_i(T_i - t)}$ - the equity forward price

$S$ – the equity spot price at valuation date

$PV_i(D) = \sum_{t<\tau<T_i} d_\tau e^{-r_i(\tau - t)}$ - the present value of all dividends between $t$ and $T_i$

$d_\tau$ – the discrete dividend paid at $\tau$ where $t \le \tau \le T$

$r_i$ – the continuously compounded interest rate from t to $T_i$

**The present value of dividends is given by**

$$PV_{dividend}(t) = \propto \sum_{i=1}^{n} \frac{d_i D_i}{S_{i-1}}$$

where

$\alpha$ - shares

$d_i$ – dividend payoff during a reset period

$D_i$ – discount factor

$S_i = [S - PV_i(D)]e^{r_i(T_i - t)}$ - the equity forward price

**The present value of the equity leg is the sum of equity PV and dividend PV.**

$$PV_{equity}(t) = PV_{asset}(t) + PV_{dividend}(t)$$

**The present value of a floating interest rate leg can expressed as**

$$PV_{floating}(t) = \sum_{i=1}^{m} N_i(F_i + s)\tau_i D_i$$

where

$t$ – the valuation date

$N_i = \alpha S_{i-1}$ – the notational principal amount

$\alpha$ - shares

$i$ – the $i^{th}$ cash flow (swaplet) from $I$ to $n$

$\tau_i = \tau(T_{i-1}, T_i)$ – the accrual period $(T_{i-1}, T_i)$ of the $i^{th}$ cash flow.

$D_i = D(t, T_i)$ – the discount factor

$F_i = F(t; T_{i-1}, T_i) = \frac{1}{\tau_i}\left(\frac{D_{i-1}}{D_i} - 1\right)$ $F_i = \frac{1}{\tau_i}\left(\frac{D_{i-1}}{D_i} - 1\right)$- the simply compounded forward rate

$s$ - the floating spread

**The present value of the equity swap from the equity receiver perspective is given by**

$$PV(t) = PV_{equity}(t) - PV_{floating}$$

**This is so-called the projection based approach that applies to normal cases. However, if a client unwinds, the accrual based approach is desirable, where payoff is slightly different.**

**<u>Test Your Understanding:</u>**

**What is the role of equity dealer?**

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## 14.5 Summary

1. An equity swap is similar to an interest rate swap, but rather than one leg being the "fixed" side, it is based on the return of an equity index.

2. These swaps are highly customizable and are traded over-the-counter. Most equity swaps are conducted between large financing firms such as auto financiers, investment banks, and lending institutions.

3. The interest rate leg is often referenced to LIBOR while the equity leg is often referenced to a major stock index such as the S&P 500.

4. The primary advantages are the following:

    a. **Financial survival** – A debt/equity swap may offer the company the best chance of weathering financial difficulties.

    b. **Preservation of credit rating** – By not defaulting on loan payments, the company can maintain its credit rating.

    **(c)Lowest cost alternative** – A debt/equity swap may be a company's cheapest way to obtain needed capital.

5. Potential disadvantages to executing a debt/equity swap are as follows:

    a. **May not solve the problem** – The company may continue to suffer financial stresses even after doing the swap.

    b. **Paying too high a price** – The lender may ask for an equity interest that represents a much higher financial price than the outstanding loan balance.

    **(c)Loss of equity** – By giving away part of the company's equity, the owners lose part of their interest and control in the business.

## 14.6 Self-Assessment Questions

1. What is spread on equity swap?

2. How do you value an equity swap?

3. How does equity swap work?

4. What are the pros and cons of choosing a equity swap?

## 14.7 Suggested Readings


1. Kolb,R.W. & Overdhal,J.A., Financial Derivatives, John Wiley & Sons, Inc.

2. Kumar, S.S.S., Financial Derivatives, PHI Learning Private Limited.

3. Parasuraman,N.R., Fundamentals of Financial Derivatives, Wiley India Pvt. Ltd.

4. Gupta, S.L., Financial Derivatives, PHI Private Limited

# UNIT 15: CREDIT SWAPS

**Unit Structure:**



## 15.0 Unit Objective

The present unit highlights the conceptual framework of credit swaps with examples.

## 15.1 Meaning

A credit default swap (CDS) is a financial derivative or contract that allows an investor to "swap" or offset his or her credit risk with that of another investor. For example, if a lender is worried that a borrower is going to default on a loan, the lender could use a CDS to offset or swap that risk. To swap the risk of default, the lender buys a CDS from another investor who agrees to reimburse the lender in the case the borrower defaults. Most CDS will require an on-going premium payment to maintain the contract, which is like an insurance policy.

A credit default involve municipal swap is the bonds, emerging most common form of credit market bonds, mortgage-backed derivative and may securities or corporate bonds.

A credit default swap is designed to transfer the credit exposure of fixed income products between two or more parties. In a CDS, the buyer of the swap makes payments to the swap's seller until the maturity date of a contract. In return, the seller agrees that – in the event that the debt issuer (borrower) defaults or experiences another credit event – the seller will pay the buyer the security's value as well as all interest payments that would have been paid between that time and the security's maturity date.

In the CDS world, a credit event is a trigger that causes the buyer of protection to terminate and settle the contract. Credit events are agreed upon when the trade is entered into and are part of the contract. The majority of single-name CDSs are traded with the following credit events as triggers: reference entity bankruptcy, failure to pay, obligation acceleration, repudiation, and moratorium. A credit default swap is a type of credit derivative contract.

Bonds and other debt securities have risk that the borrower will not repay the debt or its interest. Because debt securities will often have lengthy terms to maturity, as much as 30 years, it is difficult for the investor to make reliable estimates about that risk over the entire life of the instrument.

Credit default swaps have become an extremely popular way to manage this kind of risk. The U.S. Comptroller of the Currency issues a quarterly report on credit derivatives and in a report issued in June 2020, it placed the size of the entire market at $4 trillion, of which CDS accounted for $3.5 trillion.

**Why Would People Buy Credit Default Swaps?**

- **Hedge against risk.** Suppose an investment fund owned mortgage bonds from riskymortgage.co.uk. It might be worried about losing all its investment. Therefore, to hedge against the risk of default, they could purchase a credit default swap from Lloyds TSB. If riskymortgage.co.uk defaulted, they will lose their investment, but receive a pay-off from

Lloyds to compensate. If they don't default, they have paid a premium to Lloyds but have had security.

**2. Speculation e.g. risk is under-priced.**

Suppose a hedge fund felt risky mortgage was very likely to default because of a rise in home repossessions. They would buy a credit default swap. If the debt defaulted, then they would make a profit from Lloyds TSB. Note you don't have to actually own debt to take a credit default swap.

The riskier a bond is the higher premium will be required from a buyer of a credit default swap. It is argued that credit default swaps provide an important role in indicating the riskiness/creditworthiness of a firm.

**3. Arbitrage**

If a company's financial position improves, the credit rating should also improve and therefore, the CDS spread should fall to reflect improved rating. This makes CDS more attractive to sell CDS protection. If the company position deteriorated, CDS protection would be more attractive to buy. Arbitrage could occur when dealers exploit any slowness of the market to respond to signals.

## 15.2 Credit SWAP Transaction

In a CDS transaction, there are a minimum of two parties: one who's selling risk and another who's buying risk. The seller is selling risk protection for an underlying asset, which may take the form of municipal bonds, mortgage-backed securities, corporate bonds or emerging market bonds. The buyer's part of the transaction is to pay the seller a premium to cover the possibility of a credit event that affects the quality of the underlying asset. A CDS covers risk that includes mortgage defaults, bankruptcy filings, debt restructuring and downgrades in a bond's credit rating.

For example, let's say an investor owns a group of municipal bonds and is worried that the credit rating for those bonds will be downgraded. They can —swap‖ that risk by buying a CDS from another investor who will reimburse them if the bonds end up being downgraded.

The seller charges a premium for this risk protection and also makes an agreement as part of the bargain. If a negative credit event affects the underlying asset – in this example, municipal bonds – the seller will pay the buyer of the CDS the value of the asset or security, along with any interest that would have been paid up until the bonds' maturity date. So both sides can benefit through a swap arrangement.

The nature of a CDS is what makes it like an insurance contract. You have one party agreeing to pay the other if something unforeseen happens. In a life insurance contract, for instance, the insurance company agrees to pay your beneficiaries a death benefit if you pass away.

## 15.3 Illustration

### 15.3.1 Illustration 1

An investment trust owns £1 million corporate bond issued by a private housing firm. If there is a risk the private housing firm may default on

repayments, the investment trust may buy a CDS from a hedge fund. The CDS is worth £1 million. The investment trust will pay interest on this credit default swap of say 3%. This could involve payments of £30,000 a year for the duration of the contract. If the private housing firm doesn't default, the hedge fund gains the interest from the investment bank and pays nothing out. It is simple profit. If the private housing firm does default, then the hedge fund has to pay compensation to the investment bank of £1 million – the value of the credit default swap. Therefore the hedge fund takes on a larger risk and could end up paying £1million
The higher the perceived risk of the bond, the higher the interest rate the hedge fund will require.

### 15.3.2 Illustration 2

Suppose that Lloyds TSB has lent money to riskymortgage.co.uk in the form of a £1,000 bond. Lloyds TSB may then purchase a credit default swap from another company e.g. a Hedge Fund. If the firm (Riskymortgage.co.uk) default on the loan, then the hedge fund will pay Lloyds TSB the value of the loan.

Thus Lloyds TSB has insurance against loan default. The hedge fund has the opportunity to make a profit, so long as the firm does not default on the loan.

The riskier the loan, the higher will be the premium required on buying a credit default swap.

**<u>Test Your understanding:</u>**

**What happens if no credit event occurs during the life of a single name credit default swap?**

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## 15.4 Summary

1. Credit default swaps, or CDS, are credit derivative contracts that enable investors to swap credit risk on a company, country, or other entity with another counterparty.

2. Credit default swaps are the most common type of OTC credit derivatives and are often used to transfer credit exposure on fixed income products in order to hedge risk.

3. Credit default swaps are customized between the two counterparties involved, which makes them opaque, illiquid, and hard to track for regulators

## 15.5 Self-Assessment Questions

1. What is credit default swaps?

2. How are credit default swaps settled?

3. How does a credit swap work?

4. Who uses credit default swaps?

5. What are the merits and demerits of credit swap?

## 15.6 Suggested Readings


1. Kolb,R.W. & Overdhal,J.A., Financial Derivatives, John Wiley & Sons, Inc.

2. Kumar, S.S.S., Financial Derivatives, PHI Learning Private Limited.

3. Parasuraman,N.R., Fundamentals of Financial Derivatives, Wiley India Pvt. Ltd.

4. Gupta, S.L., Financial Derivatives, PHI Private Limited

Uttar Pradesh Rajarshi Tandon
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# MBA-3.21
## MASTERS OF BUSINESS ADMINISTRATION

# Block
# V

## OPTIONS GREEKS , RISK MANAGEMENT, ACCOUNTING & TAXATION AND POLICY FRAMEWORK

# MBA – 3.21


## Curriculum Design Committee

**Prof Omji Gupta** **Coordinator**
Director,
School of Management Studies, UPRTOU, Allahabad
**Dr Gyan Prakash Yadav**
Asst Professor **Member**
School of Management Studies, UPRTOU, Allahabad
**Dr Devesh Ranjan Tripathi**
Asst Professor **Member**
School of Management Studies, UPRTOU, Allahabad
**Dr Gaurav Sankalp** **Member**
School of Management Studies, UPRTOU, Allahabad

## Course Preparation Committee

**Dr Ekta Verma** **Author**
Asst. Professor
MONIRBA,University
Of Allahabad

**Prof. S. A. Ansari** **Editor**
Ex Head and Dean MONIRBA,
University of Allahabad

**Dr Gaurav Sankalp** **Coordinator MBA SLM writing**
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## BLOCK 5 - OPTIONS GREEKS, RISK MANAGEMENT, ACCOUNTING & TAXATION AND POLICY FRAMEWORK

**This Block comprises of Five Units namely:**

**UNIT 16** Option Greeks-1: Delta, Meaning of and limits on value of Delta, Assumption of Linearity, Behaviour of Delta, Delta and Time to Maturity; Theta, Meaning of Theta, Theta and Time.

**UNIT 17** Option Greeks- 2 ; Gamma and Gamma Neutrality, Computing Gamma, Behaviour of Gamma with Spot Price and Time, Meaning of Gamma; Vega: Meaning and Illustrations; Rho: Meaning and Illustrations.

**UNIT 18** Value at Risk (VaR): Meaning, Management Process, Types, Relevance and Uses.

**UNIT 19** Accounting and Taxation: Process, types, relevance and uses.

**UNIT 20** Derivatives Regulation Framework in India: Policy, Types, Relevance, Merits and

**UNIT 16-** Option Greeks-1: Delta, Meaning of and limits on value of Delta, Assumption of Linearity, Behaviour of Delta, Delta and Time to Maturity; Theta, Meaning of Theta, Theta and Time.

**Unit Structure**

## 16.0 Unit Objevtives

This unit gives us a detailed explanation of Greeks- Delta, Theta ,its behaviour and also helps us in understanding the various calculations involves in calculating it.

## 16.1 Options Greeks – Introduction

Option Greeks are financial measures of the sensitivity of an option's price to its underlying determining parameters, such as volatility or the price of the underlying asset. The Greeks are utilized in the analysis of an options portfolio and in sensitivity analysis of an option or portfolio of options. The measures are considered essential by many investors for making informed decisions in options trading.

Delta, Gamma, Vega, Theta, and Rho are the key option Greeks. However, there are many other option Greeks that can be derived from those mentioned above.

| Name | Dependent Variable | Independent Variable |
|---|---|---|
| Delta | Option price | Value of underlying asset |
| Gamma | Delta | Value of underlying asset |
| Vega | Option price | Volatility |
| Theta | Option price | Time to maturity |
| Rho | Option price | Interest rate |

KEY TAKEAWAYS

1. The 'Greeks' refer to the various dimensions of risk that an options position entails.

2. Greeks are used by options traders and portfolio managers to hedge risk and understand how their p&l will behave as prices move.

3. The most common Greeks include the Delta, Gamma, Theta, and Vega - which are first partial derivatives of the options pricing model.

## 16.2 Delta

### Meaning:

Delta is a measure of the change in an option's price (that is, the premium of an option) resulting from a change in the underlying security. The value of delta ranges from -100 to 0 for puts and 0 to 100 for calls (-1.00 and 1.00 without the decimal shift, respectively).3 Puts generate negative delta because they have a negative relationship with the underlying security—that is, put premiums fall when the underlying security rises, and vice versa.

Conversely, call options have a positive relationship with the price of the underlying asset. If the underlying asset's price rises, so does the call premium, provided there are no changes in other variables such as implied volatility or time remaining until expiration. If the price of the underlying asset falls, the call premium will also decline, provided all other things remain constant.

A good way to visualize delta is to think of a race track. The tires represent the delta, and the gas pedal represents the underlying price. Low delta options are like race cars with economy tires. They won't get a lot of traction when you rapidly accelerate. On the other hand, high delta options are like drag racing tires. They provide a lot of traction when you step on the gas. Delta values closer to 1.00 or -1.00 provide the highest levels of traction.

### Example of Delta

For example, suppose that one out-of-the-money option has a delta of 0.25, and another in-the-money option has a delta of 0.80. A $1 increase in the price of the underlying asset will lead to a $0.25 increase in the first option and a $0.80 increase in the second option. Traders looking for the greatest traction may want to consider high deltas, although these options tend to be more expensive in terms of their cost basis since they're likely to expire in-the-money.

An at-the-money option, meaning the option's strike price and the underlying asset's price are equal, has a delta value of approximately 50 (0.5 without the decimal shift). That means the premium will rise or fall by half a point with a one-point move up or down in the underlying security.

In another example, if an at-the-money wheat call option has a delta of 0.5 and wheat rises by 10 cents, the premium on the option will increase by approximately 5 cents (0.5 x 10 = 5) or $250 (each cent in a premium is worth $50).

Delta changes as the options become more profitable or in-the-money. In-the-money means that a profit exists due to the option's strike price being more favorable to the underlying's price. As the option gets further in the money, delta approaches 1.00 on a call and -1.00 on a put with the extremes eliciting a one-for-one relationship between changes in the option price and changes in the price of the underlying.

In effect, at delta values of -1.00 and 1.00, the option behaves like the underlying security in terms of price changes. This behavior occurs with little or no time value as most of the value of the option is intrinsic.

**Test Your Understanding**

**What is Delta?**

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## 16.3 Behaviour of Delta

Delta changes as the options become more profitable or in-the-money. In-the-money means that a profit exists due to the option's strike price being more favorable to the underlying's price. As the option gets further in the money, delta approaches 1.00 on a call and -1.00 on a put with the extremes eliciting a

one-for-one relationship between changes in the option price and changes in the price of the underlying.

In effect, at delta values of -1.00 and 1.00, the option behaves like the underlying security in terms of price changes. This behavior occurs with little or no time value as most of the value of the option is intrinsic.

## Probability of Being Profitable

Delta is commonly used when determining the likelihood of an option being in-the-money at expiration. For example, an out-of-the-money call option with a 0.20 delta has roughly a 20% chance of being in-the-money at expiration, whereas a deep-in-the-money call option with a 0.95 delta has a roughly 95% chance of being in-the-money at expiration.

The assumption is that the prices follow a log-normal distribution, like a coin flip.

On a high level, this means traders can use delta to measure the risk of a given option or strategy. Higher deltas may be suitable for high-risk, high-reward strategies with low win rates while lower deltas may be ideally suited for low-risk strategies with high win rates.

## Delta and Directional Risk

Delta is also used when determining directional risk. Positive deltas are long (buy) market assumptions, negative deltas are short (sell) market assumptions, and neutral deltas are neutral market assumptions.

When you buy a call option, you want a positive delta since the price will increase along with the underlying asset price. When you buy a put option, you want a negative delta where the price will decrease if the underlying asset price increases. Three things to keep in mind with delta:

1. Delta tends to increase closer to expiration for near or at-the-money options.

2. Delta is further evaluated by gamma, which is a measure of delta's rate of change.

3. Delta can also change in reaction to implied volatility changes.

**Test your understanding**

**What is the relation between Delta and Directional risk**

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## 16.4 Delta and Time to Maturity

At maturity, delta has a digital shape around the strike. Once we move ourselves away from maturity, the delta becomes much smoother shaped. The further we are from maturity, the flatter the curve looks.

The delta converges faster and faster to its intrinsic value as time to maturity goes to zero. The option picks its direction. That is true, except for ATM option, where the delta remains flatter. Main variation from the delta is always located in the ATM range. The closer we are to maturity, the tighter the range is where the delta changes from small value to full value.

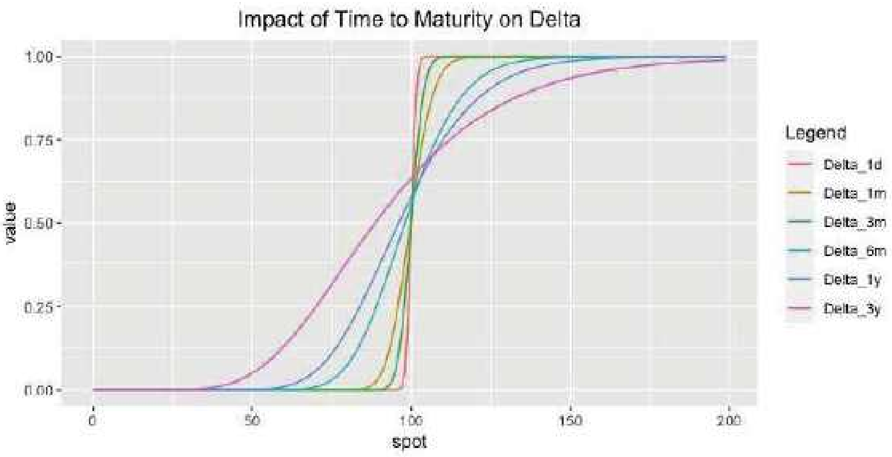


Fig 16.5: Impact of Time to Maturity on Delta

Since delta hedging is uncertain and implies transaction costs, there is a willingness to keep it to a minimum. In practice, delta hedges are usually done on a daily basis.

Since time impacts delta, one should adjust its effect on delta for weekends and holidays even though the underlying does not move during these days. The closer to maturity, the more important this adjustment.

The effect of time on delta is represented by a second-order sensitivity called the charm.

### 16.4.1 Impact of Volatility

The trader wants to know and understand how the delta will change when volatility changes. It will allow him to anticipate the hedge adjustments and take a position accordingly.

A higher volatility increases the delta for OTM options. The more volatility, the less OTM an OTM option really is.

A higher volatility decreases the delta for ITM options. The more volatility, the less ITM an ITM option really is.

More volatile stocks therefore have a less pronounced delta.

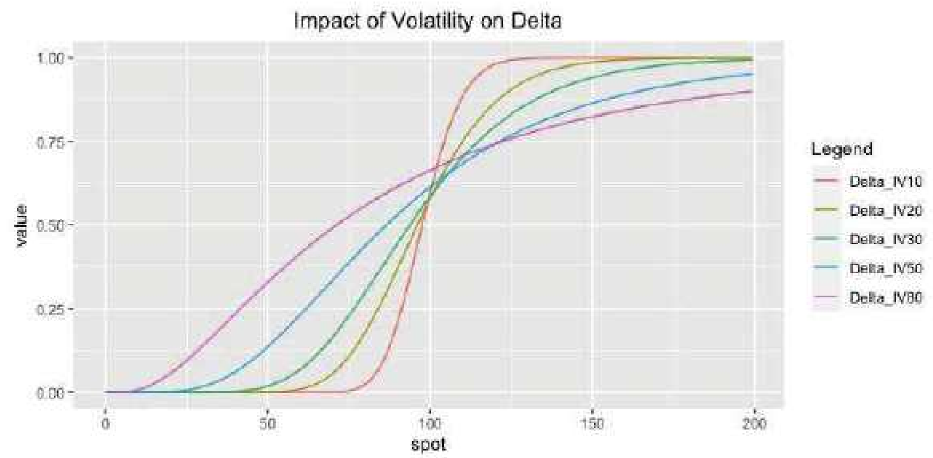


Fig. 16.4.1 Impact of Volatility on Delta

## 16.5 Other factors linked to delta hedge

**Liquidity**

Liquidity is also a concern. A trader will adjust his price if the underlying stock is illiquid and difficult to trade. For example, if a stock is hard to short, then borrowing costs will have to be factored into the price.

**Dividends**

As sellers of structured products, banks are structurally long the underlying assets as their delta hedge consists of buying delta on these assets. Being long underlying means they are also long dividends. To obtain a correct option price and hedge, dividends will have to be taken into account.

However, dividends are uncertain. So, how should they be factored into the price?

It can be done in the form of a term structure of dividend yields or priced at current levels and hedged using dividend swaps.

On a book level, exposures to dividends can be significant and will need to be hedged. **Interest Rates**

To buy delta, a trader has to borrow money. If interest rates go up, borrowing becomes more expensive making the hedging process and therefore the option price more expensive. The sensitivity of an option price to interest rate movements will be further discussed in the section on Theta.

## 16.6 Setting up a small delta-hedging experiment

Let us try to understand how to manage a book of derivatives. Suppose we know the stock is following the Black-Scholes dynamics. We could then analyse how the delta hedge procedure works. If this theory is solid, we should be able to eliminate all risks while hedging.

**Market conditions**

Interest rates are at a 2% level. The underlying stock pays no dividend and follows a geometric Brownian Motion with $\mu = 10\%$ and $\sigma = 20\%$. The initial spot price is 100€100€. The call option is at-the-money with a maturity of 0.1 year.

We are going to delta hedge at regular time step with $dt = 0.005$ so that there are 20 steps. We will generate sample paths of the stocks by generating standard normal deviates and use the known formula. From the time series, we can calculate back the realised volatility after the experiment –> realized volatility = 17%.

**First Day**

The trader sells the option at a price of 2.62€, corresponding to an implied volatility of 20%.He will also use this implied volatility for hedging purpose, which prescribed a delta of 52.52% so

that he buys 0.5252 stocks. He does this by borrowing (0.5252∗100€−2.62€)=49.90€(0.5252∗100€−2.62€)=49.90€. After the first day, the trader has the following instruments in his book:

₹ A sold call option at 2.62€2.62€.

₹ A loan with a present value of 49.90€49.90€.

₹ A stock portfolio with a value of 52.52€52.52€.

**Second Day**

The outstanding loan is increased because of the interest effect. In this case, the effect is about 1 cent. The stock has decreased by 10 cents. Because of the delta-position, his stock portfolio loses about 5 cents. The sold option loses more than just 5 cents. All of this brings the trader's book at a positive value.

After the change in the market, the delta has changed to 41.83%. The trader will thus sell part of his stock portfolio at the current level. With this cash, he pays back part of the loan. The trader is in a new delta-neutral position to start the next day.

**Observations**

***The theory of Black-Scholes is prescribing that the hedging cost leads to the option price. However, we notice a profit coming into the book after just one day of hedging! Why?***

The reason is that the theory assumes that you are hedging continuously through time, rather than once a day. So the error is induced by the discrete nature of the hedging strategy.

Another way of looking at this is by analyzing the random number that was used to generate the value of the second day. This number is a draw from the standard normal distribution. This one is a small number.

One could say that the volatility of the first day, because of this small draw, is smaller than actually predicted by the distribution. It is smaller than the "typical" number in a standard normal distribution.

*Which random number one has to use in order to see no profit and no loss in this first day?*
Z = -1 or +1 --> one standard deviation out of the mean.

## Conclusion

Every day where the move of the stock is less than anticipated, based on volatility, the trader will have a gain in his book.

Every day where the move of the stock is bigger than anticipated, based on volatility, the trader will have a loss in his book.

Because of the statistical nature and the assumed independence of the moves on a daily basis, his losses and gains will average each other out, at least if the volatility that realizes corresponds to the pricing volatility at the start.

### *What happens if right after the price agreement has been done, the market volatility drops to 5%?*

This means that the trader will see a nice profit in his book. However, this profit will die out if trader hedges the option during the lifetime, because the final P&L will depend on how the realized volatility turns out. The smart trader would try to buy back this option in the market if possible and hence lock in this margin.

As we explained in this delta-hedging procedure, there are discrete effects. Up to now, we only have a qualitative understanding of those. No worries, the introduction of gamma and theta will help us quantify them.

**<u>Test your Understanding</u>**

**What is the impact of volatility on Delta**

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## 16.7 Theta- Meaning & Example

Theta measures the rate of time decay in the value of an option or its premium. Time decay represents the erosion of an option's value or price due to the passage of time. As time passes, the chance of an option being profitable or in-the-money lessens. Time decay tends to accelerate as the expiration date of an option draws closer because there's less time left to earn a profit from the trade.

Theta is always negative for a single option since time moves in the same direction. As soon as an option is purchased by a trader, the clock starts ticking, and the value of the option immediately begins to diminish until it expires, worthless, at the predefined expiration date.
Theta is good for sellers and bad for buyers. A good way to visualize it is to imagine an hourglass in which one side is the buyer, and the other is the seller. The buyer must decide whether to exercise the option before time runs out. But in the meantime, the value is flowing from the buyer's side to the seller's side of the hourglass. The movement may not be extremely rapid, but it's a continuous loss of value for the buyer.

Theta values are always negative for long options and will always have a zero time value at expiration since time only moves in one direction, and time runs out when an option expires.

**Example of Theta:**

An option premium that has no intrinsic value will decline at an increasing rate as expiration nears.

Table 6 shows theta values at different time intervals for an S&P 500 Dec at-the-money call option. The strike price is 930.

As you can see, theta increases as the expiration date gets closer (T+25 is expiration). At T+19, or six days before expiration, theta has reached 93.3, which in this case tells us that the option is now losing $93.30 per day, up from $45.40 per day at T+0 when the hypothetical trader opened the position.

**Table 6: Example of Theta values for short S&P Dec 930 call option**

| - | T+0 | T+6 | T+13 | T+19 |
|---|---|---|---|---|
| **Theta** | **45.4** | **51.85** | **65.2** | **93.3** |

Theta values appear smooth and linear over the long-term, but the slopes become much steeper for at-the-money options as the expiration date grows near. The extrinsic value or time value of

the in- and out-of-the-money options is very low near expiration because the likelihood of the price reaching the strike price is low.

In other words, there's a lower likelihood of earning a profit near expiration as time runs out. At-the-money options may be more likely to reach these prices and earn a profit, but if they don't, the extrinsic value must be discounted over a short period. Some additional points about theta to consider when trading:

2. Theta can be high for out-of-the-money options if they carry a lot of implied volatility.

3. Theta is typically highest for at-the-money options since less time is needed to earn a profit with a price move in the underlying.

4. Theta will increase sharply as time decay accelerates in the last few weeks before expiration and can severely undermine a long option holder's position, especially if implied volatility declines at the same time.

## 16.8 Theta & Time

### Theta depends on moneyness

The real potential of an option is found in the ATM range.

Let us take an example where we buy an ATM put initially and imagine different scenario.

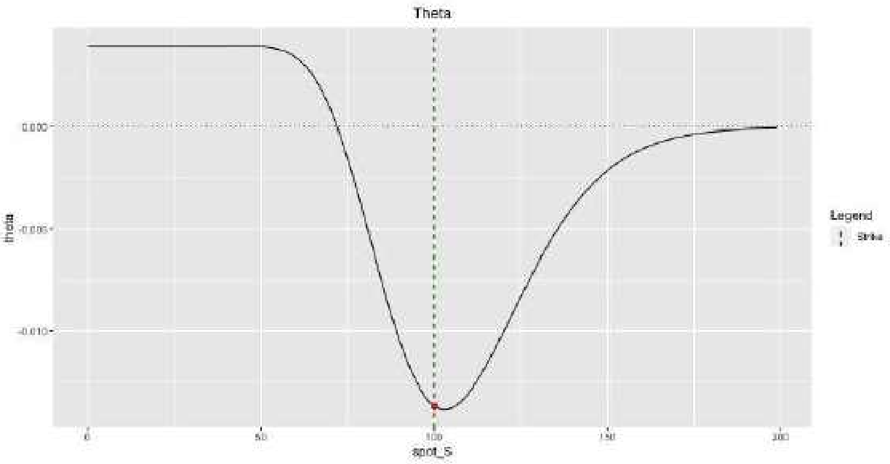


Fig. 16.9: Put Theta

Note that at first sight the theta is negative, there are 2 situations where it turns positive.

- ITM put options are known to have positive time decay (see figure 4.12). Remember we have seen that the time value of ITM put options can be negative, so nothing really surprising here!

- For ITM call options, the theta can turn positive as well, in the case where the dividend yield is larger than interest rates so that the forward level is below the current spot level. Figure 4.11 does not reflect this as if plots the Theta of a 1-year call option on a non-dividend-paying stock in a positive interest rate world.

**Case 1 : From ATM to ITM**

Initially the put option is ATM but then the stock moves down and the put price rises. Although the put value increased, the time value is less than for ATM option. Clearly, if the time value is less altogether, there is less value to lose when time passes.

**Case 2 : From ATM to ITM then back to ATM**

Suppose the trader owns an
ATM put option.

During the first week, the stock does not move so that both time value and option value decrease.

During the second week, the stock drops by 10% so that option price increases (due to intrinsic value) and time value decreases.

We know that if the time value is smaller, the daily decrease in time value is lower than before the actual move.

If the stock moves back up to the ATM level, the option value goes down but the time value increases. As of then, the daily decrease in time value is more substantial than before this move back up.

***How all the changes in time value add up ?***

This is the topic of the next section, where we see the theta in relation to the gamma.

Over the lifetime the sum of all changes in time value on a daily basis just add up to the option premium of the first day.

The reason behind this is nothing else but the fact that an option converges to its intrinsic value. The creation of extra time value is a temporary effect.

**Test your Understanding**

**What do you understand by Theta**

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## 16.9 Summary

1. Greeks, including Delta, Gamma, Theta, Vega and Rho, measure the different factors that affect the price of an option contract. They are calculated using a theoretical options pricing model. Since there are a variety of market factors that can affect the price of an option in some way, assuming all other factors remain unchanged, we can use these pricing models to calculate the Greeks and determine the impact of each factor when its value changes.

2. **Delta** is the first-order sensitivity of the price to a movement in the spot price, S. It gives the equity sensitivity of the option and is closely related to the probability of the option finishing in-the-money. Delta is normally quoted in percent and gives how much of percentage of the actual stock is required to hedge the option.

3. Delta changes as the options become more profitable or in-the-money. In-the-money means that a profit exists due to the option's strike price being more favorable to the underlying's price. As the option gets further in the money, delta approaches 1.00 on a call and -1.00 on a put with the extremes eliciting a one-for-one relationship between changes in the option price and changes in the price of the underlying.

4. Theta measures the rate of time decay in the value of an option or its premium. Time decay represents the erosion of an option's value or price due to the passage of time. As time passes, the chance of an option being profitable or in-the-money lessens. Time decay tends to accelerate as the expiration date of an option draws closer because there's less time left to earn a profit from the trade.

5. Some additional points about theta to consider when trading:

6. Theta can be high for out-of-the-money options if they carry a lot of implied volatility.

7. Theta is typically highest for at-the-money options since less time is needed to earn a profit with a price move in the underlying.

8. Theta will increase sharply as time decay accelerates in the last few weeks before expiration and can severely undermine a long option

holder's position, especially if implied volatility declines at the same time.

## 16.10 Self Assesment Questions

1. Explain Option Greeks.

2. What is delta. Explain with the help of examples.

3. Explain the relationship between delta and time to maturity.

4. Discuss theta giving an example.

5. Does theta depends on moneyness?

## 16.11 Suggested Readings


1. Kolb,R.W. &Overdhal,J.A., Financial Derivatives, John Wiley & Sons, Inc.

2. Kumar, S.S.S., Financial Derivatives, PHI Learning Private Limited.

3. Parasuraman,N.R., Fundamentals of Financial Derivatives, Wiley India Pvt. Ltd.

4. Gupta, S.L., Financial Derivatives, PHI Private Limited.

## Unit 17- Options Greeks- 2: Gamma and Gamma Neutrality, Computing Gamma, Behaviour of Gamma with Spot Price and Time, Meaning of Gamma; Vega: Meaning and illustrations; Rho: Meaning and illustrations

### Unit Structure

## 17.0 Unit Objectives

This unit gives a detailed overview of Gamma, Behaviour of Gamma with Spot Price and time. It explains Vega and Rho with suitable examples.

## 17.1 Gamma- Meaning

Gamma measures the rate of changes in delta over time. Since delta values are constantly changing with the underlying asset's price, gamma is used to measure the rate of change and provide traders with an idea of what to expect in the future. Gamma values are highest for at-the-money options and lowest for those deep in- or out-of-the-money.

While delta changes based on the underlying asset price, gamma is a constant that represents the rate of change of delta. This makes gamma useful for determining the stability of delta, which can be used to determine the likelihood of an option reaching the strike price at expiration.

### Example of Gamma:

Suppose that two options have the same delta value, but one option has a high gamma, and one has a low gamma. The option with the higher gamma will have a higher risk since an unfavorable move in the underlying asset will have an oversized impact. High gamma values mean that the option tends to experience volatile swings, which is a bad thing for most traders looking for predictable opportunities.

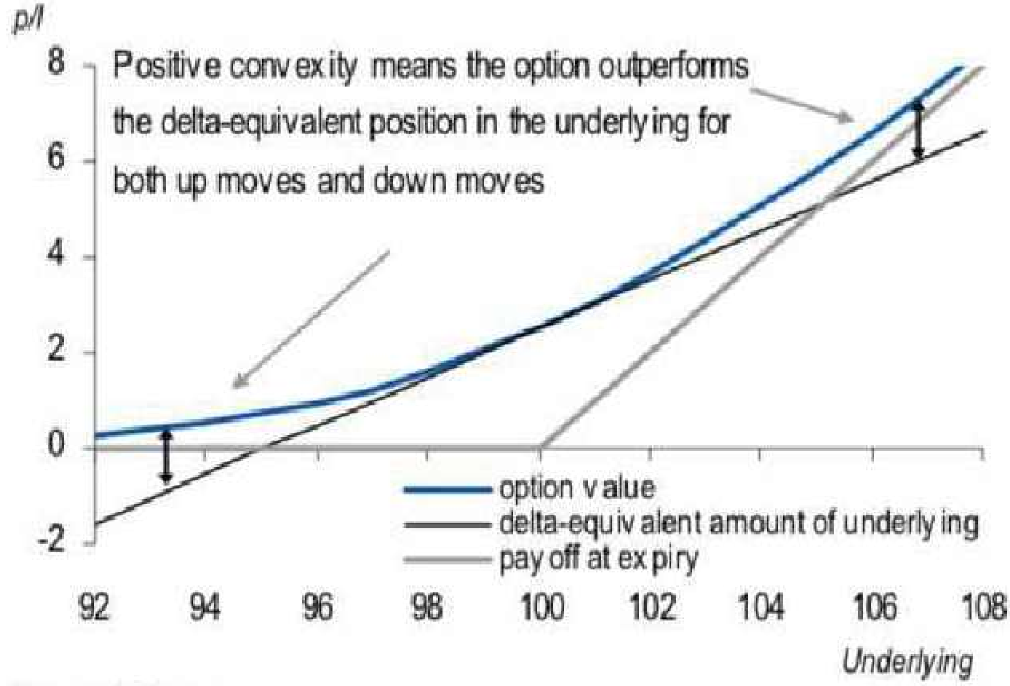
A good way to think of gamma is the measure of the stability of an option's probability. If delta represents the probability of being in-the-money at expiration, gamma represents the stability of that probability over time.

An option with a high gamma and a 0.75 delta may have less of a chance of expiring in-the-money than a low gamma option with the same delta.

## 17.2 Computing Gamma

Gamma measures the change in delta due to the change in underlying price. It represents the second-order sensitivity of the option to a movement in the underlying asset's price. The higher the gamma, the more convex the theoretical payout.

Be careful that gamma is not a measure of value! A low/high gamma option does not mean a cheap/expensive option. An option's implied volatility is a measure of its value, not its gamma. The price of an option as a function of the underlying price is non-linear. Gamma allows for a second-order correction to delta to account for this convexity.




Source : JPMorgan

This convexity in the underlying price is what gives the option value. It is important as it enables the traders to derive the profit on an option for any given stock move.

A delta-hedged portfolio is a portfolio that has been hedged by trading in the underlying asset against small movements in these assets (black line).

As a second-order effect, the gamma becomes significant when large move in the underlying occurs (convexity seen in the blue curve).

As we can see in the above figure, a long position in option is convex and there has a positive gamma. To delta hedge, the trader will need to sell stocks if the stock price goes up and buy stocks if the stock price goes down (sell high – buy low). The trader can sit on the bid and offer.

A short position in option is negative gamma. In this case, the trader will need to sell stocks if the stock price goes down and buy stocks if the stock price goes up to be delta hedged (sell low – buy high). The trader has to cross the bid-offer spread.

**Gamma Hedging**

To hedge this gamma, we need to trade other convex instruments such as other European options so that gammas cancel out. A lower gamma means that we will have a lower need for large and frequent rebalancing of delta.

To see the second-order effect in pricing, we will use models that assume some form of randomness in asset's price.

**<u>Test your understanding</u>**

**What is Gamma and how it is calculated?**

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## 17.3 Behaviour of Gamma with price and Time

**Moneyness**

Gamma tells us how much delta will move if the underlying moves. Gamma generally has its peak value close to ATM and decreases as the option goes deeper ITM or OTM. Options that are deeply ITM/OTM have gamma close to zero.

**Time to Maturity**

We have seen that delta get smoother for larger time to maturity. So we can expect a smoother gamma for a longer maturity.

As the time to expiration draws nearer, gamma of ATM options increases while gamma of ITM/OTM options decreases.

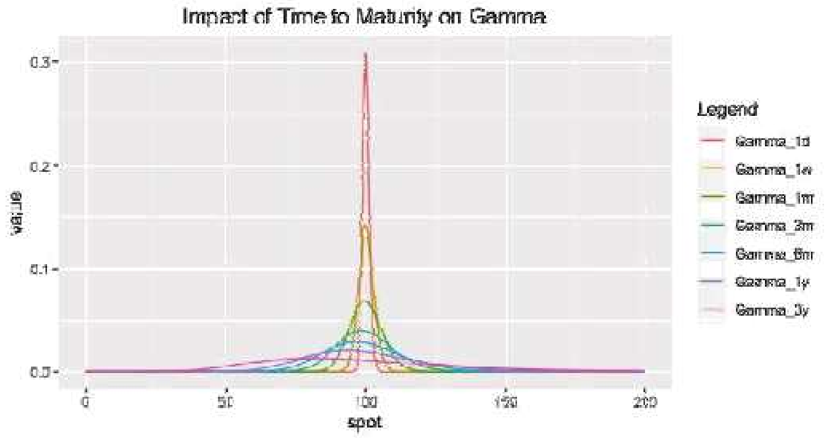


Fig. 17.3: Impact of Time to Maturity on Gamma

## 17.3.1 Volatility

We have seen that volatility attacked the delta, so it is not surprising it weakened the gamma too. Since a higher volatility induces a less pronounced S-shape delta curve, it also induces a less pronounced/wider more stable bell-curved gamma.

A higher volatility lowers the gamma in the ATM region and increases the gamma in the ITM/OTM regions.

It is very easy to think about this effect in terms of time value of options.

For low levels of volatility, deep ITM/OTM options have little time value and can only gain time value if the underlying asset moves closer to strike.

For high levels of volatility, both ITM/OTM options have time value and the gamma near strike should not be too different from away from strike. Therefore, gammas tend to be more stable across all strike prices.

We can say that volatility weakens the gamma.

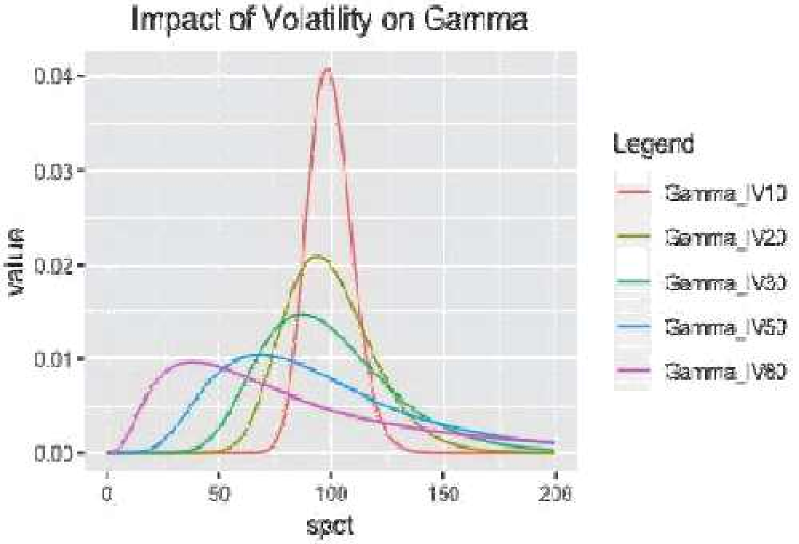


Fig: 17.3.1: Impact of Volatility on Gamma

## 17.3.2 Negative Gamma at maturity is tricky

The gamma of a European option is high when the underlying trades near the strike and there is little time left to maturity. Around this point, the trader will need to delta hedge more frequently, making the hedging process more expensive.

Intuitively, the delta of a call option on the day of expiry will change from roughly 0% when the spot is lower than the strike to roughly 100% when the spot is larger than the strike. Therefore a small change in spot will result in a large change in delta and gamma is very high. Any trader that has sold options can tell you how tricky it is to manage the book near maturity when the spot is around the option's strike. The gamma gets so big that the hedging needs to be done very fast. As he is the option seller, he is gamma short, with a huge gamma position. If the market keeps moving around the strike, every rebalance will cost him money and the amount of theta for is limited.

In some cases, in highly volatile markets, it is sometimes better to either fully hedge at once or fully unwind. If you are wrong, it will cost you, but rebalancing can be even more costly (slippage or bid/offer spreads).

### 17.3.3 Gamma P&L

Options are exposed to a wide range of factors such as: performance of the underlying asset, time, volatility, interest rates, dividends, etc.

The first-order exposure to moves in the underlying can be hedged out by the familiar delta-hedging process. This leaves the exposure to volatility, paid for in time-decay as the most important sensitivity. However, this is not a pure volatility exposure as it is **path dependent**.

Suppose we hold a call option. To be delta-neutral, we can sell an amount of the underlying equivalent to the delta of the option. By frequently re-adjusting this delta-hedge, sensitivity to asset moves can be dynamically hedged out over option's lifetime.

P&L will come from the accumulated action of continuously re-balancing to keep the portfolio delta-neutral over time. The gamma P&L is paid for in the option premium, which is marked to market as lost theta.

#### An example

A trader is long gamma through buying a put option. If the market is right and balanced, the trader paid a fair price so that the money he can expect to make will be paid for through premium.

Assume the market suddenly realizes that the option was underpriced. Expectation now becomes that the stock will be more volatile so that the implied volatility increase and the option becomes more expensive in the market.

The trader has a choice. He can keep on delta hedging and profit from this highly volatile market or he can cash in and sell the option at a higher price.

***How much money can he expect to make over the lifetime of the option if he continues hedging himself?***

That amount can be shown to be identical to cashing in right now. Underlying this statement, there is the assumption that the implied volatility turns out to be the correct one.

This actually gives the trader an interesting dilemma. Because the market will keep changing his mind over time about the best implied volatility that has to be used. Option traders will take positions when they think the implied volatility is low/high. The money they will pick up by trading is directly related to the vega of these options.

**Test your understanding**

**What is the impact of volatility on Gamma?**

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## 17.4 Vega

Vega measures the risk of changes in implied volatility or the forward-looking expected volatility of the underlying asset price. While delta measures actual price changes, vega is focused on changes in expectations for future volatility. Higher volatility makes options more expensive since there's a greater likelihood of hitting the strike price at some point.

Vega tells us approximately how much an option price will increase or decrease given an increase or decrease in the level of implied volatility. Option sellers benefit from a fall in implied volatility, but it is just the reverse for option buyers.

It's important to remember that implied volatility reflects price action in the options market. When option prices are bid up because there are more buyers, implied volatility will increase. Long option traders benefit from pricing being bid up, and short option traders benefit from prices being bid down. This is why long options have a positive vega, and short options have a negative Vega.

Additional points to keep in mind regarding vega:

- Vega can increase or decrease without price changes of the underlying asset, due to changes in implied volatility.
- Vega can increase in reaction to quick moves in the underlying asset.
- Vega falls as the option gets closer to expiration.

### 17.4.1 Vega sensitivities

#### Moneyness

Vega generally has its peak value close to ATM and decreases as the option goes deeper ITM or OTM. Options that are deeply ITM/OTM have vega close to zero.

#### Volatility

A higher volatility results in a wider vega curve, meaning a vega curve that is more flat. This points to the fact that in highly volatile markets the ATM point is less defined. The ATM region has become bigger.

***Higher volatility does not necessarily mean higher vega in the ATM point!***

The vega does not depend strongly on the level of volatility used, at least not once a certain critical level of volatility is reached.

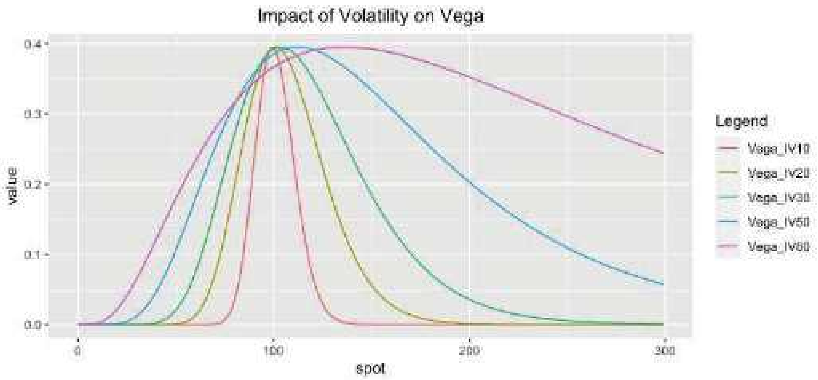


Fig: 17.4.1: Impact of Volatility on Vega

## 17.4.2 Time to Maturity

We know that options lose their time value as time passes and we approach the expiry. It is not surprising that the volatility sensitivity or vega dies out.

Vega/Gamma have the same qualitative behaviour: largest ATM vs ITM/OTM. However, they

have opposite dynamic behaviour: gamma spikes towards maturit y whereas vega dies out.

If we want to capture forward volatility, then we have to trade options with the largest vega. If we want to trade the spot volatility, then we have to trade options with largest gamma.

When the option is away from the strike levels, vega drops very quickly with time. Only ATM options can hold their vega for a longer time.

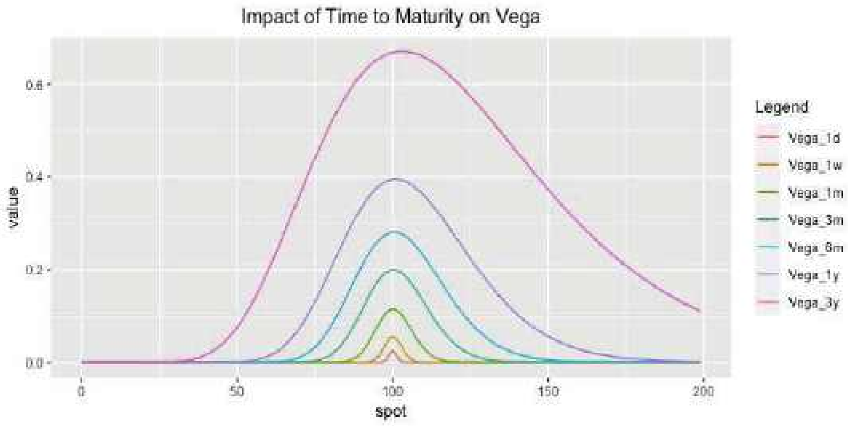

Fig: 17.4.2 : Impact of Time to Maturity on Vega

For more exotic structures, the vega profile can change sign, and whether we are short or long volatility depends on the underlying's price.

The ATM option is almost linear in volatility. The prices of the ITM and OTM options are convex in volatility up to a certain level then become linear for large volatilities.

**Test your understanding**

**What are Vega Sensitivities?**

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## 17.5 Rho

Rho represents the sensitivity of an option's price to a movement in interest rates. As t he delta, it is positive for calls and negative for puts.

The prices of vanilla options are almost linear in interest rates. In other words, it only has a first-order effect. This effect comes from the impact of interest rates on the cost of the delta-hedge and the discounting of the option price. The second effect is generally smaller than the first one.

### 17.5.1 Rho sensitivities

**Moneyness**

Rho is larger for ITM options and decreases steadily as the option changes to become OTM.

## 17.5.2 Time to Maturity

Rho increases as time to expiration increases. Long-dated options are far more sensitive to changes in interest rates than short-dated options.

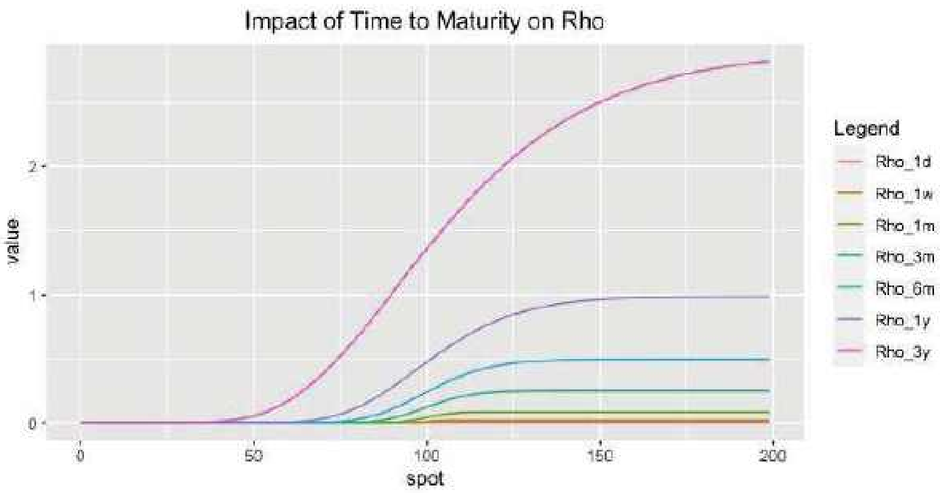


Fig:17.5.2 : Impact of Time to Maturity on Rho

Though rho is a primary input in the Black-Scholes model, a change in interest rates generally has a minor overall impact on the pricing of options. Because of this, rho is usually considered to be the least important of all the option Greeks.

## 17.5.3 Rho Hedging

We recall from delta-hedging procedure that we were using a cash account, where we

received/were charged an interest rate r, continuously compounded, meaning every day we

would receive/pay interest.

This is a source of uncertainty.

One can expect that the interest received for cash is lower than the interest to be paid for a loan. This typical bid/offer spread in interest rate market is the first of our problems. What's next?

The interest rates are not constant. So we don't know in advance what the applicable rate interest rate is.

If we have a certain amount on the cash account, we could fix the interest rates for the lifetime of the option, but only for this fixed volume.

Because of the dynamic nature of the hedging procedure, the cash on the account will constantly change and a few days later, the conditions in the market might have changed. So, the best we can do is fix as much as we can at the start of the procedure, where we have at least an accurate view on the money in the cash account. For the future, the trader will use an estimate of the future interest rates.

The problem of uncertain interest rates in the context of equity derivatives is sometimes handled by the bank by fixing an internal system.

**<u>Test your understanding</u>**

**What is Vega and Vega Hedging?**

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## 17.6 Summary

- Gamma measures the rate of changes in delta over time. Since delta values are constantly changing with the underlying asset's price, gamma is used to measure the rate of change and provide traders with an idea of what to expect in the future. Gamma values are highest for at-the-money options and lowest for those deep in- or out-of-the-money.

- Gamma tells us how much delta will move if the underlying moves. Gamma generally has its peak value close to ATM and decreases as the option goes deeper ITM or OTM. Options that are deeply ITM/OTM have gamma close to zero.

- Vega measures the risk of changes in implied volatility or the forward-looking expected volatility of the underlying asset price. While delta measures actual price changes, vega is focused on changes in expectations for future volatility. Higher volatility makes options more expensive since there's a greater likelihood of hitting the strike price at some point.

- Vega generally has its peak value close to ATM and decreases as the option goes deeper ITM or OTM. Options that are deeply ITM/OTM have vega close to zero.

- Rho represents the sensitivity of an option's price to a movement in interest rates. As the delta, it is positive for calls and negative for puts. The prices of vanilla options are almost linear in interest rates. In other words, it only has a first-order effect. This effect comes from the impact of interest rates on the cost of the delta-hedge and the discounting of the option price. The second effect is generally smaller than the first one.

- Rho increases as time to expiration increases. Long-dated options are far more sensitive to changes in interest rates than short-dated options.

## 17.7 Self Assesement Questions

1. Explain Gamma with the help of suitable examples.

2. How is Gamma calculated?

3. Discuss behaviour of Gamma with price and time.

4. What is Vega? Discuss.

5. Expain Rho and its sensitivities.

## 17.8 Suggested Readings


1. Kolb,R.W. &Overdhal,J.A., Financial Derivatives, John Wiley & Sons, Inc.

2. Kumar, S.S.S., Financial Derivatives, PHI Learning Private Limited.

3. Parasuraman,N.R., Fundamentals of Financial Derivatives, Wiley India Pvt. Ltd.

4. Gupta, S.L., Financial Derivatives, PHI Private Limited.

## UNIT 18- Value at Risk (VaR): Meaning, Management Process, Types, Relevance and Uses

### Unit Structure

## 18.0 Unit Objectives

This unit gives us a detailed explanation of Value at Risk and also helps us in understanding the various calculations involves in calculating it.

## 18.1 Value at Risk (VaR)- Meaning

Value at risk is a statistic that measures and quantifies the level of financial risk within a firm, portfolio or position over a specific time frame. This metric is most commonly used by

investment and commercial banks to determine the extent and occurrence ratio of potential losses in their institutional portfolios.

Risk managers use to measure and control the level of risk exposure. One can apply calculations to specific positions or whole portfolios or to measure firm-wide risk exposure.

**Understanding Value at Risk (VaR)**

VaR modeling determines the potential for loss in the entity being assessed and the probability of occurrence for the defined loss. One measures VaR by assessing the amount of potential loss, the probability of occurrence for the amount of loss, and the timeframe.

For example, a financial firm may determine an asset has a 3% one-month VaR of 2%, representing a 3% chance of the asset declining in value by 2% during the one-month time frame. The conversion of the 3% chance of occurrence to a daily ratio places the odds of a 2% loss at one day per month.

Investment banks commonly apply VaR modeling to firm-wide risk due to the potential for independent trading desks to unintentionally expose the firm to highly correlated assets.

Using a firm-wide VaR assessment allows for the determination of the cumulative risks from aggregated positions held by different trading desks and departments within the institution. Using the data provided by VaR modeling, financial institutions can determine whether they have sufficient capital reserves in place to cover losses or whether higher-than-acceptable risks require them to reduce concentrated holdings.

### 18.1.1 Example of Problems with Value at Risk (VaR) Calculations

There is no standard protocol for the statistics used to determine asset, portfolio or firm-wide risk. For example, statistics pulled arbitrarily from a period of low volatility may understate the potential for risk events to occur and the magnitude of those events. Risk may be further understated using normal distribution probabilities, which rarely account for extreme or black-swan events.

The assessment of potential loss represents the lowest amount of risk in a range of outcomes. For example, a VaR determination of 95% with 20% asset risk represents an expectation of losing at

least 20% one of every 20 days on average. In this calculation, a loss of 50% still validates the risk assessment.

The financial crisis of 2008 that exposed these problems as relatively benign VaR calculations understated the potential occurrence of risk events posed by portfolios of subprime mortgages. Risk magnitude was also underestimated, which resulted in extreme leverage ratios within subprime portfolios. As a result, the underestimations of occurrence and risk magnitude left institutions unable to cover billions of dollars in losses as subprime mortgage values collapsed.

3. Value at risk (VaR) is a statistic that measures and quantifies the level of financial risk within a firm, portfolio or position over a specific time frame.

4. This metric is most commonly used by investment and commercial banks to determine the extent and occurrence ratio of potential losses in their institutional portfolios.

5. Investment banks commonly apply VaR modeling to firm-wide risk due to the potential for independent trading desks to unintentionally expose the firm to highly correlated assets.

### 18.1.2 Calculation of value at risk

The power of value-at-risk lies in its generality. Unlike market risk metrics such as the Greeks, duration or beta, which are applicable to only certain asset categories or certain sources of market risk, value-at-risk is general. It is based on the probability distribution for a portfolio's market value. All liquid assets have uncertain market values, which can be characterized with probability distributions. All sources of market risk contribute to those probability distributions. Being applicable to all liquid assets and encompassing, at least in theory, all sources of market risk, value-at-risk is a broad metric of market risk.

The generality of value-at-risk poses a computational challenge. In order to measure market risk in a portfolio using value-at-risk, some means must be found for determining the probability distribution of that portfolio's market value. Obviously, the more complex a portfolio is—the more asset categories and sources of market risk it is exposed to—the more challenging that task becomes.

**Test your understanding**

**What is value at risk?**

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## 18.1.3 Value-at-Risk as a Quantile of Loss

It is worth distinguishing two concepts:

1. A **value-at-risk measure** is an algorithm with which we calculate a portfolio's value-at-risk.

2. A value-at-risk metric is our interpretation of the output of the value-at-risk measure.

3. value-at-risk metric, such as one-day 90% USD VaR, is specified with three items:

   a. a time horizon;

   b. a probability;

   c. a currency.

7. value-at-risk measure calculates an amount of money, measured in that currency, such that there is that probability of the portfolio not losing more than that amount of money over that time horizon. In the terminology of mathematics, this is called a quantile, so one-day 90% USD VaR

is just the 90% quantile of a portfolio's one day loss in US dollars.

This is worth emphasizing: value-at-risk is a quantile of loss. The task of a value-at-risk measure is to calculate such a quantile.
**Value-at-Risk: Preliminary Definitions**

For a given value-at-risk metric, measure time in units—days, weeks, months, etc.—equal to the time horizon. Let time 0 be now, so time 1 represents the end of the horizon. We know a portfolio's current market value ${}^{0}p$. Its market value ${}^{1}P$ at the end of the horizon is unknown.

Here, as in other contexts, I use the convention that unknown (i.e. random) quantities are capitalized while known quantities are lower-case. Preceding superscripts indicate time, so ${}^{0}p$ is the portfolio's known current value, and ${}^{1}P$ is its unknown market value at the end of the horizon
– at time t = 1.

Define portfolio loss $^{1}L$ as

$$^{1}L = {}^{0}p - {}^{1}P[1]$$

If $^{0}p$ exceeds $^{1}P$, the loss will be positive. If $^{0}p$ is less than $^{1}P$, the loss will be negative, which is another way of saying the portfolio makes a profit.

**Calculating Value-at-Risk as a Quantile of Loss**

Because we don't know the portfolio's future value $^{1}P$, we don't know its loss $^{1}L$. Both are random variables, and we can assign them probability distributions. That is exactly what a value-at-risk measure does. It assigns a distribution to $^{1}P$ and/or $^{1}L$, so it can calculate the desired quantile of $^{1}L$. Most typically, value-at-risk measures work directly with the distribution of $^{1}P$ and use that to infer the quantile of $^{1}L$.

This is illustrated in Exhibit 1 for a 90% VaR metric. Working with the probability distribution of $^{1}P$, first the 10% quantile of $^{1}P$ is found. Then, subtracting this from the portfolio's current market value $^{0}p$ gives the 90% quantile of $^{1}L$. This is the portfolio's value-at-risk – the amount of money such that there is a 90% probability that the portfolio will either make a profit or lose less than that amount.

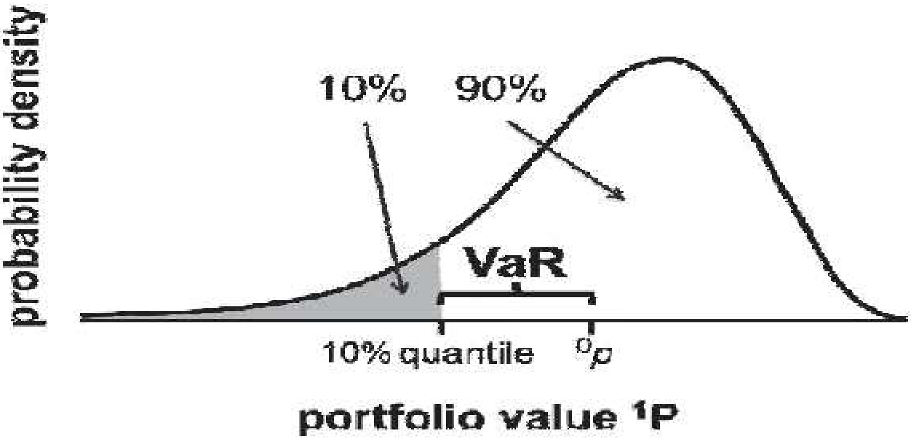


**Exhibit 1:** A portfolio's 90% VaR is the amount of money such that there is a 90% probability of the portfolio losing less than that amount of money—the 90% quantile of $^{1}L$. This exhibit illustrates how that quantity can be calculated

as the portfolio's current value ${}^0p$ minus the 10% quantile of ${}^1P$. Other value-at-risk metrics can be valued similarly.

Other value-at-risk metrics can be valued similarly. So if we know the distribution for ${}^1P$, calculating value-at-risk is easy. The challenge for any value-at-risk measure is constructing that distribution of ${}^1P$. Value-at-risk measures do so in various ways, but all practical value-at-risk measures share certain features described below.

**Risk Factors**

Because value-at-risk measures are probabilistic, they deal with various random financial variables. Three types are particularly significant and are given standard notation:

4. a portfolio value ${}^1P$;

5. asset values ${}^1S_i$; and

6. key factors ${}^1R_i$.

We have already discussed portfolio value ${}^1P$, which is the portfolio's market value at time 1— the end of the value-at-risk horizon. The portfolio has current value ${}^0p$.

**Asset values** $S_i$ represent the accumulated value at time 1 of individual assets that might be held by the portfolio at time 0. Individual assets might be stocks, bonds, futures, options or other instruments. Let m be the total number of assets to be modeled. The m asset values ${}^1S_i$ comprise

an ordered set (an m-dimensional vector) called the **asset vector**, which we denote ${}^1\mathbf{S}$. Its current value ${}^0\mathbf{s}$ is the ordered set of asset current values ${}^0s_i$. I am using the notation convention of making multivariate quantities – vectors or matrices – bold.

$$ {}^1\boldsymbol{S} = \begin{pmatrix} {}^1S_1 \\ {}^1S_2 \\ \vdots \\ {}^1S_m \end{pmatrix} \quad {}^0\boldsymbol{s} = \begin{pmatrix} {}^0s_1 \\ {}^0s_2 \\ \vdots \\ {}^0s_m \end{pmatrix} $$

[2]

**Key factors** ${}^{1}R_i$ represent values at time 1 of financial variables that can be used to value the assets. Depending on the composition of the portfolio, key factors might represent exchange rates, interest rates, commodity prices, spreads, implied volatilities, etc. The n key factors ${}^{1}R_i$ comprise an ordered set called the **key vector,** which we denote ${}^{1}\mathbf{R}$. This has current value ${}^{0}\mathbf{r}$:

$$
{}^{1}\boldsymbol{R} = \begin{pmatrix} {}^{1}R_1 \\ {}^{1}R_2 \\ \vdots \\ {}^{1}R_n \end{pmatrix} \qquad {}^{0}\boldsymbol{r} = \begin{pmatrix} {}^{0}r_1 \\ {}^{0}r_2 \\ \vdots \\ {}^{0}r_n \end{pmatrix}
$$

[3]

Past values of the key vector are also required:

$$
{}^{-1}\boldsymbol{r} = \begin{pmatrix} {}^{-1}r_1 \\ {}^{-1}r_2 \\ \\ {}^{-1}r_n \end{pmatrix} \quad {}^{-2}\boldsymbol{r} = \begin{pmatrix} {}^{-2}r_1 \\ {}^{-2}r_2 \\ \vdots \\ {}^{-2}r_n \end{pmatrix} \quad \cdots \quad {}^{-\alpha}\boldsymbol{r} = \begin{pmatrix} {}^{-\alpha}r_1 \\ {}^{-\alpha}r_2 \\ \vdots \\ {}^{-\alpha}r_n \end{pmatrix}
$$

[4]

Together, current and past values for the key vector, ${}^{0}\mathbf{r}$, ${}^{-1}\mathbf{r}$, ${}^{-2}\mathbf{r}$, … , ${}^{-\alpha}\mathbf{r}$, are called **historical market data.**

**Calculating Value-at-Risk: The Big Picture**

Where are we going with this? The quantities ${}^{1}P$, ${}^{1}S_i$ and ${}^{1}R_i$ are all random. But the portfolio's value ${}^{1}P$ is a function of the values ${}^{1}S_i$ of the assets it holds. Those in turn are a function of the key factors ${}^{1}R_i$. For example, a Treasury bond portfolio's value ${}^{1}P$ is a function of the values ${}^{1}S_i$ of the individual bonds it holds. Their values are in turn functions of applicable interest rates ${}^{1}R_i$.

Because a function of a function is a function, ${}^{1}\mathbf{P}$ is a function θ of ${}^{1}\mathbf{R}$: ${}^{1}\mathbf{P} = \theta({}^{1}\mathbf{R})$

Value-at-risk measures apply time series analysis to historical data ${}^{0}\mathbf{r}$, ${}^{-1}\mathbf{r}$, ${}^{-2}\mathbf{r}$, … , ${}^{-\alpha}\mathbf{r}$ to construct a joint probability distribution for ${}^{1}\mathbf{R}$. They then exploit the functional relationship θ between ${}^{1}\mathbf{P}$ and ${}^{1}\mathbf{R}$ to convert that joint distribution into a distribution for ${}^{1}\mathbf{P}$. From that distribution for ${}^{1}\mathbf{P}$, value-at-risk is calculated, as illustrated in Exhibit 1 above.

Exhibit 2 summarizes the components common to all practical value-at-risk measures: We describe those components next.

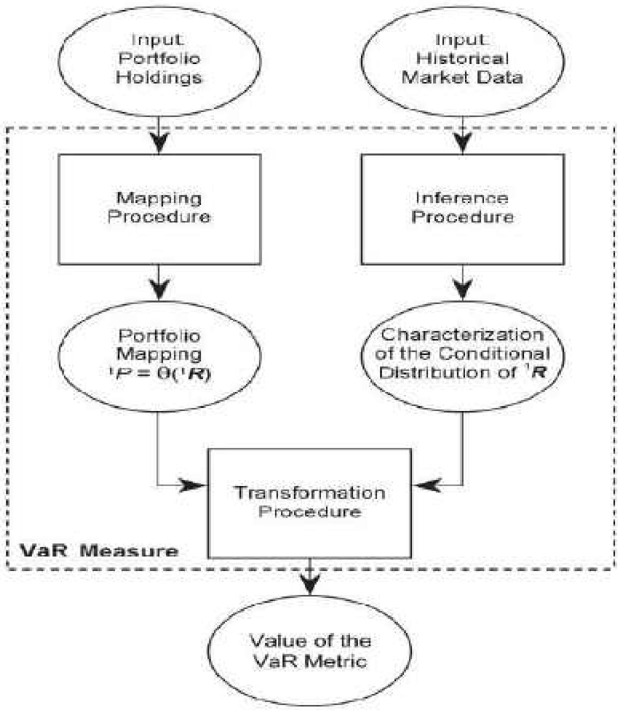


**Exhibit 2:** All practical value-at-risk measures accept portfolio holdings and historical market data as inputs. They process these with a mapping procedure, inference procedure, and transformation procedure. Output comprises the value of a value-at-risk metric. That value is the value-at-risk measurement.

## 18.1.4 Value-at-Risk Inputs

7. value-at-risk measure accepts two inputs:

historical data ${}^{0}\mathbf{r}, {}^{-1}\mathbf{r}, {}^{-2}\mathbf{r}, \ldots, {}^{-\alpha}\mathbf{r}$ for ${}^{1}\mathbf{R}$, and

the portfolio's holdings $\omega$.

The portfolio holdings comprise a row vector $\omega$ whose components indicate the number of units held of each asset. For example, if a portfolio holds 1000 shares of IBM stock, 5000 shares of Google stock and a short position of 3000 shares of Microsoft stock, its holdings are

2. = (1000 5000 –3000)[6]

## 18.2 Inference and Mapping Procedures

The two inputs—historical data and portfolio holdings—are processed separately by two procedures within the value-at-risk measure:

2. An inference procedure applies methods of time series analysis to the historical data ${}^{0}\mathbf{r}, {}^{-1}\mathbf{r}, {}^{-2}\mathbf{r}, \ldots, {}^{-\alpha}\mathbf{r}$ to construct a joint distribution for ${}^{1}\mathbf{R}$.

3. A mapping procedure uses the portfolio's holdings $\omega$ to construct a function $\theta$ such that ${}^{1}P = \theta({}^{1}\mathbf{R})$.

The mapping procedure uses a set of pricing functions $\varphi_i$ that value each asset ${}^{1}S_i$ in terms of ${}^{1}\mathbf{R}$:

${}^{1}S_i = \varphi_i({}^{1}\mathbf{R})$ [7]

For example, if asset ${}^{1}S_1$ is a bond, pricing formula $\varphi_1$ will be a bond pricing formula. If asset ${}^{1}S_2$ is an equity option, pricing formula $\varphi_2$ will be an equity option pricing formula.

A functional relationship ${}^{1}P = \theta({}^{1}\mathbf{R})$ is then defined as a weighted sum of the pricing formulas $\varphi_i$, with the weights being the holdings $\omega_i$:

${}^{1}P = \omega_1 {}^{1}S_1 + \omega_2 {}^{1}S_2 + \ldots + \omega_m {}^{1}S_m$[8]

$\square\, \omega_1\varphi_1(^1\mathbf{R}) + \omega_2\varphi_2(^1\mathbf{R}) + \ldots + \omega_m\varphi_m(^1\mathbf{R})$ [9]

This is called a **primary mapping**. If a portfolio is large or holds complex instruments, such as derivatives or mortgage-backed securities, a primary mapping may be computationally expensive to value. Many mapping procedures replace a primary mapping θ with a simpler approximation . Such approximations are called remapping. They can take many forms. Two common examples are remapping that are constructed, using the method of least squares, as either a linear polynomial or quadratic polynomial approximation of θ. Such remapping are called, respectively, linear remapping and quadratic remapping.

Most of the literature on value-at-risk is either elementary or theoretical, so remapping receive little mention. This is unfortunate. As a practical tool for making production value-at-risk measures tractable, remapping can be indispensable.

## 18.3 Transformation Procedures

Returning to Exhibit 2, we have discussed the two inputs to a value-at-risk measure as well as the inference procedure and mapping procedure that process these. If you think about it, the two outputs of those procedures correspond to the two components of risk. As explained by Holton (2004), every risk has two components:

- uncertainty
- exposure

In the context of market risk, we are uncertain if we don't know what will happen in the markets. We are exposed if we have holdings in instruments traded in those markets. A value-at-risk measure characterizes uncertainty with the joint distribution for $^1\mathbf{R}$ constructed by its inference procedure. It characterizes exposure with the portfolio mapping θ constructed by its mapping procedure. A value-at-risk measure must combine those two components to measure a portfolio's market risk, and it does so with a transformation procedure. A transformation procedure accepts as inputs

1. a joint distribution for **R**, and
2. a portfolio mapping θ, which can be either a primary mapping or a remapping.

It uses these to construct a distribution for $^{1}$P from which it calculates the portfolio's value-at-risk.

Transformation procedures take various forms, but there are essentially three types:

3. Linear transformation procedures apply if the portfolio mapping θ is a linear polynomial. They employ a standard formula from probability theory for calculating the variance of a linear polynomial of a random vector. For certain asset categories, such as equities or futures, primary mappings can be liner polynomials. Alternatively, θ may be a linear remapping.

4. Quadratic transformation procedures apply if the portfolio mapping θ is a quadratic polynomial and the joint distribution of **R** is joint-normal. Primary mappings are almost never quadratic polynomials, so quadratic transformations assume use of a quadratic remapping.

5. Monte Carlo transformation procedures employ the Monte Carlo method and are applicable to all portfolio mappings. This advantage comes with potentially significant computational expense, as Monte Carlo transformation procedures entail revaluing the portfolio under numerous scenarios. A subcategory of Monte Carlo transformation procedures do not randomly generate scenarios but instead construct them directly from historical data for **R**. These are called historical transformation procedures.

Elementary treatments of value-at-risk often mention ―methodsǁ for calculating value-at-risk. Mostly, these reference the transformation procedures used. For example, the terms ―parametric methodǁ or ―variance-covariance methodǁ refer to value-at-risk measures that employ a liner transformation procedure. The ―delta-gamma methodǁ refers to those that use a quadratic transformation procedure. The ―Monte Carlo methodǁ and ―historical methodǁ refer, of course, to value-at-risk measures that use Monte Carlo or historical transformation procedures.

## 18.4 Relevance of Value at Risk (VaR)

Value at Risk is one unique and consolidated measure of risk, which has been at the center of much expectations, popularity and controversy. It is also referred to as a summary statistic which quantifies the asset or portfolio's exposure to market risk. It has been in the news for many wrong reasons as much popularity it gained among the financial market dealers since 2008 wall street crash. Later economists and analysts have been able to develop more comprehensive and reliable VaR stats but the basic characteristic of all the measure remains the same or at least they are derived from Traditional VaR statistic. Here we will take a look at what are the qualities which made this statistic gain popularity and notoriety at the same time. Given below are relevance of Traditional VaR estimate:

(e) VaR is probability based and allows the users to interpret possible losses for various confidence levels.

(f) It is a consistent measurement of financial risk as it uses the possible dollar loss metric enabling the analysts to make direct comparisons across different portfolios, assets or even business lines.

(g) VaR is calculated based on a common time horizon, and thus, allows for possible losses

to be quantified for a particular period.

The choice of confidence level is usually based on the industry requirements or reporting norms suggested by the Regulators. Choice of time horizon will depend on the type of asset being analyzed, for example:

- On a common stock it can be estimated for any horizon depending on the frequency of trade or user requirement.
- On a portfolio VaR can be calculated for a period of turnover only; i.e. till the time portfolio holdings remain consistent, as the holding changes or in other words if a trade is recorded in the portfolio the VaR has to be calculated again. Therefore, time-horizon for a portfolio depends on the frequency of trading in its assets.
- For a business analysis it may depend on the employee evaluation periods, key decision making events etc. could provide the possible time horizons.
- Regulatory and taxation requirements
- External Quality Assessments etc.

- It is important to note that VaR comparison between two portfolios, business lines or assets requires that the two variables, i.e. time horizon and confidence level, be consistent for all the portfolios being compared.

## 18.5 Uses of Value at Risk (VaR)

1. Risk Management
2. Financial Control
3. Financial Reporting and
4. Computing Regulatory Capital.

**VaR is sometimes used in non-financial applications as well.**

The greatest benefit of VAR is that it imposes a structured methodology for critically measuring risk. Institutions that go through the process of computing their VAR are forced to keep a check on their exposure to financial risks and to set up a proper risk management function. Thus the process of getting to VAR may be as important as the number itself.

The other benefit of VaR is that it allows organizations to divide risk in two parts.

1. Inside the VaR Limit
2. Outside the VaR Limit

"A risk manager has two jobs: make people take more risk the 99% of the time it is safe to do so, and survive the other 1% of the time. VaR is the border. So by using VaR the limit of the Risk that can be undertaken is defined.

**In the early 1990s, three events dramatically expanded use of value-at-risk:**

1. The Group of 30 (1993) published a groundbreaking report on derivatives practices. It was influential and helped shape the emerging field of financial risk management. It promoted the use of value-at-risk by derivatives

dealers and appears to be the first publication to use the phrase —value-at-risk.‖

2. JP Morgan (1994) released the first detailed description of value-at-risk as part of its free Risk Metrics service. This was intended to promote the use of value-at-risk among the firm's institutional clients. The service comprised a technical document describing how to implement a VaR measure and a covariance matrix for several hundred key factors updated daily on the internet.

3. In 1995, the Basel Committee on Banking Supervision implemented market risk capital requirements for banks. These were based upon a crude value-at-risk measure, but the committee also approved, as an alternative, the use of banks' own proprietary VaR measures in certain circumstances.

**<u>Test your understanding</u>**

**Discuss the relevance and uses of VaR**

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## 18.6 Criticism of VaR

VaR is compared to "an airbag that works all the time, except when you have a car accident."

**The major criticism of VaR is:**

1. Led to excessive risk-taking and leverage at financial institutions
2. Focused on the manageable risks near the center of the distribution and ignored the tails
3. Created an incentive to take "excessive but remote risks"
4. Was "potentially catastrophic when its use creates a false sense of security among senior executives and watchdogs."

## 18.7 Limitation of VaR

**These are some common limitations of VaR:**

- Referring to VaR as a "worst-case" or "maximum tolerable" loss. In fact, you expect two or three losses per year that exceed one-day 1% VaR.
- Making VaR control or VaR reduction the central concern of risk management. It is far more important to worry about what happens when losses exceed VaR.
- Assuming plausible losses will be less than some multiple, often three, of VaR. The entire point of VaR is that losses can be extremely large, and sometimes impossible to define, once you get beyond the VaR point. To a risk manager, VaR is the level of losses at which you stop trying to guess what will happen next, and start preparing for anything.
- Reporting a VaR that has not passed a backtest. Regardless of how VaR is computed, it should have produced the correct number of breaks

(within sampling error) in the past. A common specific violation of this is to report a VaR based on the unverified assumption

that everything follows a multivariate normal distribution.

**Test your understanding**

**What are of the limitations of VaR?**

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## 18.8 Summary

(1) Value at risk is a statistic that measures and quantifies the level of financial risk within a firm, portfolio or position over a specific time frame. This metric is most commonly used by investment and commercial banks to determine the extent and occurrence ratio of potential losses in their institutional portfolios.

(2) VaR modeling determines the potential for loss in the entity being assessed and the probability of occurrence for the defined loss. One measures VaR by assessing the amount of potential loss, the probability of occurrence for the amount of loss, and the timeframe.

(3) A **value-at-risk measure** is an algorithm with which we calculate a portfolio's value-at-risk.

(4) A value-at-risk metric, such as one-day 90% USD VaR, is specified with three items:

(a) a time horizon;

(b) a probability;

(c) a currency.

(5) Transformation procedures take various forms, but there are essentially three types:

(a) Linear transformation procedures

(b) Quadratic transformation procedures

(c) Monte Carlo transformation procedures

## 18.9 Self Assesment Questions

(1) What do you understand by Value at Risk?

(2) How do you calculate Value at Risk?

(3) Why is the calculation of Value at Risk important?

(4) What are the various problems associated with the calculation of Value at Risk?

(5) List the various kinds of Risks involved.

## 18.10 Suggested Readings

1. Kolb,R.W. &Overdhal,J.A., Financial Derivatives, John Wiley & Sons, Inc.

2. Kumar, S.S.S., Financial Derivatives, PHI Learning Private Limited.

3. Parasuraman,N.R., Fundamentals of Financial Derivatives, Wiley India Pvt. Ltd.

4. Gupta, S.L., Financial Derivatives, PHI Private Limited.

## UNIT 19- Accounting and Taxation: Process, Types, Relevance and Uses

### Unit Structure



### 19.0 Unit Objectives

This Unit aims at explaining the Accounting and Taxation Process and its relevance in Financial Derivatives

### 19.1 Accounting for derivatives

According to FASB 133 para 6, —derivative instrument is a financial instrument or other contract with all three of the following characteristics:

- It has (1) one or more underlying and (2) one or more notional amounts or payment provisions or both. Those terms determine the amount of the settlement or settlements, and in some cases, whether or not a settlement is required.

- It requires no initial net investment or an initial net investment that is smaller than would be expected to have a similar response to changes in market factors.

- Its terms require or permit net settlement, it can readily be settled net by a means outside the contract or it provides for delivery of an asset that puts the recipient in a position not substantially different from net settlement.‖

According to International Accounting Standard (IAS) 39 para 10, ―a derivative is a financial instrument:

- whose value changes in response to the change in a specified interest rate, security price, commodity price, foreign exchange rate, index of prices or rates, a credit rating or credit index or similar variable (sometimes called the underlying);

- that requires no initial net investment or little initial net investment relative to other types of contracts that have a similar response to changes in market conditions; and

- that is settled at a future date.‖

From the above, it follows that the definition of derivative as per FASB 133 and IAS 39 is more or less same. Typical examples of derivatives are futures and forward, swap and option contracts. One of the defining conditions of a derivative is that it requires little initial net investment relative to other contracts that have a similar response to market conditions. An option contract meets that definition because the premium is significantly less than the investment that would be required to obtain the underlying financial instrument to which the option is linked.

If one takes Indian scenario, forward contracts are in operation for last number of years, mainly to control or to manage the foreign exchange rate risk. Since April 1996, cross currency options are allowed. Since August 1996, interest rate swaps, currency swaps, purchase of interest rate caps and collars and forward rate agreements are also allowed. Rupee-based derivatives are also allowed since August 1997 resulting into 5-year forward contract, which originally was available only for 6 months. In the equity market in India, stock index futures are available since June 2000.

There are varieties of issues attached with these developments of derivatives :

- effects on (a) capital market, (b) money market, (c) exchange rates and (d) interest rates.

- The burning issue will be taxation of derivatives and the accounting treatment.

The article published in _The Chartered Accountant' October 2000 issue deals with accounting of forward rate agreements very briefly, and Stock Index Futures in detail. It is also interesting to note here that the Institute of Chartered Accountants of India has also come out with the Guidance Note on Accounting for Index Future.

**In the light of the above developments, the present paper attempts to deal with the accounting treatment for Forward Contract, Interest Rate Swap, Currency Swap and Currency Options.**

- Forward contract :

1. The gain or loss on the hedging derivative or non-derivative instrument in a hedge of a foreign currency dominated firm commitment and the offsetting loss or gain on the hedged firm commitment shall be recognized currently in earnings in the same accounting period, as provided in para 37.

2. The gain or loss on the hedging derivative instrument in a hedge of an available for sale security and the offsetting loss or gain on the hedged available for sale security shall be recognized currently in earnings in the same accounting period, as provided in para 38.

However, it is important to note that Accounting Standard 11 does not define whether the contract should be disclosed in the balance sheet or not. According to para 27 of IAS 39, _An enterprise should recognize a financial asset

or financial liability on its balance sheet when it becomes party to contractual provisions of instrument'. According to para 28(c) of IAS 39, _A forward contract — a commitment of purchase or sell specified financial instrument or commodity subject to this standard on a future date at a specified price is recognized as an asset or a liability on the commitment date . . . . .'
From the above, it follows that once the organization enters into a forward contract, it should disclose the worth of the contract in the balance sheet in case where the contract is not settled on the balance sheet date. This can better be explained with the help of an illustration:

On 1st February 2000, an Indian company sold goods to a company in the USA for an invoice price of US $ 10000 when the spot market rate was Rs.42.70 per US $. Payment is to be received

in three months on 1-5-2000. To avoid the risk of loss from decline in the exchange rates on the date of receipt, the Indian exporter acquired a forward contract to sell US $ 10000 @ Rs.42.20 per US $, on May 1, 2000. The company's accounting year ends on 31-3-2000 and the spot rate on this date was Rs.41.70 per US $. The spot rate on 1-5-2000, the date of receipt of money by Indian exporter, was Rs.41.20. The accounting entries will be as shown in Table 1.

As per Accounting Standard 11, in case of fixed assets, effect is to be given to the fixed assets concerned and not to the profit and loss account. Hence, the deferred discount/premium will be debited or credited to the respective asset account rather than expense or income account.

The accounting entries proposed in Table 1 take care of all three viz. FASB 133, AS 11 as well as IAS 39.

- **Interest rate swap :**

—The IRS can be defined as a contract between two parties (called counter parties) to exchange on a particular date in the future, one series of cash flows (fixed interest) for other series of cash flows (variable or floating interest) in the same currency on the same principal (an agreed amount — called notional principal) for an agreed period of time.‖ (Singh Rajivkumar, "The Mechanism of Derivatives', The Chartered Accountant, December 1999, p 12)

Coming to the accounting treatment, the flow of transactions will be like this:

| | XYZ Ltd. (BBB) | ABC Ltd. (AAA) |
|---|---|---|
| Requirements | Fixed rate | Floating rate |
| Cost of fixed loan | 11% | 9.5% |
| Cost of floating rate | Prime rate +0.75% | Prime rate 10%) |

Sundry debtors 4,27,000

---

To Sales 4,27,000

---

The entry is to be passed to record agreement to exchange in 3 months US $ 10000 for Rs.422000.

Moreover, to represent the exporter's obligation to exchange US $ 10000 for Rs.422000 on May 1,

2020 also, the following entry is required to be passed. There is certainty about receivable of

Rs.422000. Obligation to pay US $10000 is accounted at the spot rate like any other receivable or

payable. This is considered as obligation because, in case where the US importer does not pay this

amount on due date, the exporter will have to buy US $ 10000 at the spot rate prevailing on this

date and meet the obligation.

Forward (Rs.) contract receivable 4,22,000

Deferred discount 5000

To Forward ($) contract payable 4,27,000

**31st March 2020**

To indicate the translation loss between date of transaction and date of closing (31-3-2020),

following entry is required to be passed :

| | |
|---|---|
| Exchange loss | 10000 |
| To Sundry debtors | 10,000 |

---

The reduction in the rate of exchange on the year-end also results in less rupees payable to

exchange dealer at spot rate on 31-3-2020. For this, following entry is to be passed :

| | |
|---|---|
| Forward ($) contract payable | 10000 |
| To Exchange gain | 10,000 |

---

| | |
|---|---|
| Discount expenses | 3334 |
| To Deferred discount | 3334 |

This indicates only proportionate discount.

**TABLE 1**

**February 1, 2020:**

**May 1, 2020**

| | |
|---|---|
| Cash | 412000 |
| Exchange loss | 5000 |
| To Sundry debtors | 417000 |

---

To account for delivery of US $ 10000 against forward contract at spot rate on 1-5-2020, following entry to be passed:

| | |
|---|---|
| Forward ($) contract payable | 417000 |
| To Exchange gains | 5000 |
| To Cash | 412,000 |
| Cash | 422000 |
| To Forward (Rs.) contract receivable | 422,000 |

---

| | |
|---|---|
| Discount expense | 1666 |
| To Deferred discount | 1666 |

**Next Financial Year**

Thus, for XYZ Ltd., even though interested in fixed rate loan, it is advisable to go for floating rate which will be 0.25% lower than fixed rate. Similarly for ABC Ltd., even though it is interested in floating rate loan, it is advisable for it to go for fixed rate as it is 0.5% lower than the floating rate. Under the circumstances, they may raise a loan the way it is cheaper and then they may enter into swap through an intermediary, a swap bank. Let us assume that the swap bank may pay fixed interest to ABC Ltd. @ 9.5% which ABC Ltd. will pass on to a lender and ABC Ltd. will effectively pay a floating rate of prime rate -.25% (9.75%) to swap bank. Hence, their effective cost will be 9.75%. Simultaneously, swap bank will pay prime rate -0.25% to XYZ Ltd., which they will pass on to floating rate lender by adding 1% (as the cost is prime rate +0.75%) and they will charge a fixed rate of 9.75%. Thus, the effective cost to XYZ Ltd. will be 10.75%, which is again 0.25% lower than the fixed rate loan raised from the market and simultaneously, the swap bank will also have net gain of 0.25%. For the purpose of accounting, let us assume that the amount borrowed from the financial institution is Rs.100,00,000. The transaction-wise accounting entries are easy to understand in the books of ABC Ltd. The accounting entries in the books of ABC Ltd. will be : At the time of borrowing :

| | | |
|---|---|---|
| Cash | 10000000 | |
| To Loan | | 10000000 |

Interest liability for six months will be :

| | | |
|---|---|---|
| Interest | 4750000 | |
| To FI | | 4750000 |
| FI | 4750000 | |
| To Cash | | 4750000 |
| Interest | 4875000 | |
| To Swap Bank | | 4875000 |
| Swap Bank | 4875000 | |
| To Cash | | 4875000 |
| Swap Bank | 4750000 | |
| To Interest | | 4750000 |
| Cash | 4750000 | |
| To Swap Bank | | 4750000 |

FASB 133 deals with fair value hedge. Accordingly, interest rate swap is the fair value hedge. According to para 22, gains and losses on qualifying fair value, hedged value shall be accounted as follows :

- the gain or loss on the hedging instrument shall be re-cognised currently in earnings.

- the gain or loss (the change in the fair value) on the hedged item, attributable to the hedged risk, shall adjust the carrying amount of the hedged item and be currently recognised in earnings.

Thus, in the above case, it is required to find out what is the fair value of swap at the year end. This is considered to be an asset till the time period is over and the gain will be credited to profit and loss account. Thus, if the fair value of the swap is, say, _X', then the entry will be

| | | |
|---|---|---|
| Swap | X | |
| To Gain on swap | | X |

Moreover, on account of swap, the market value of debt is also likely to change. Out of the total value, part may be attributable to change in the interest rate say X*. If the market value goes up it is to be considered as an obligation to pay premium. The proposed entry can be :

| | | |
|---|---|---|
| Loss on debt | X* | |
| To premium on note payable | | X* |

IAS 32, which deals with _Financial instrument : Dis-closure and Presentation' also explains, vide its para 43, that transaction in financial instru-ments may result in an enterprise's assuming or transferring to another party one or more of the financial risks viz., price risk, credit risk, liquidity risk and cash flow risk. The price risk also covers within its purview the interest rate risk, which is defined as the _risk that the value of financial instrument will fluctuate due to changes in market interest rates'. Para 49 of the IAS 32 states that when financial instrument held or issued by an enterprise, either individually or as class, creates a potentially significant exposure to the risks described in para 43 (mentioned above). Terms and conditions that may warrant disclosure include:

The principal stated face value or similar amount, which for some derivative instrument, such as, interest rate swap may be the amount on which future payments are based. Para 51 of IAS 32 also states ―similarly, it is important to disclose relation-ship between components of ‗synthetic instruments', such as, fixed rate debt created by borrowing at a floating rate and entering into a floating to fixed interest rate swap‖. In each case, the enterprise presents the individual financial assets and financial liabilities in its balance-sheet according to their nature, either separately or in the class of financial asset or financial liability to which they belong. The extent to which risk expo-sure is altered by relationship among the assets and liabilities may be apparent to financial statement users from infor-mation of the type described in para 49, but, in some circum-stances further disclosure is necessary.

According to para 57 of IAS 32, ―An enterprise provides infor-mation concerning its exposure to the effects of future changes in the prevailing level of interest rates‖. Changes in market interest rates have direct effect on the contractually determined cash flows associated with some financial assets and financial liabilities (cash flow risk) and on the fair value of others (price risk).

According to para 60, ―An enterprise indicates which of its financial assets and financia l liabilities are:

- exposed to interest rate price risk, such as monetary financial assets and financial liabilities with fixed interest rate;
- exposed to interest rate cash flow risk, such as monetary financial assets and financial liabilities with a floating interest rate that is reset as market rate changes;

- not exposed to interest rate risk such as some investment in equity securities‖.

Thus, IAS 32 included numerous provisions regarding presentation and disclosure of interest rate swap. Moreover, IAS 39, which deals with ‗Financial instruments: Recognition and measurement' — also deals with fair value hedges. According to para 153 of the same ―If fair value hedge meets the conditions in para 142 during the financial reporting period, it should be accounted as follows:

- the gain or loss from remeasuring the hedging instrument at fair value should be recognised immediately in net profit or loss; and

- the gain or loss on the hedged item attributable to the hedged risk should adjust the carrying amount of the hedged item and be recognised immediately in net profit or loss‖.

Both these are taken care of in the accounting entries proposed above.

**Currency swap :**

| | Corp. AUST | Corp. FREN |
|---|---|---|
| Requirements funding | FRF funding | AUD funding |
| Cost of AUD funding | 15% | 16% |
| Cost of FRF Funding | 11% | 10% |

In their home currencies each company has a 1% borrowing advantage. Corp. AUST for example can borrow AUD @ 15% or 1% below Corp. FREN. Similarly Corp. FREN can borrow FRF @ 10%, which is 1% below the cost to

Corp. AUST. It is this relative advantage that allows currency swap to materialise. The currency swap process is as follows:

Corp. FREN borrows FRF @ 10% and Corp. AUST borrows AUD @ 15%.

- The two companies then exchange the debt with each other so that Corp. AUST has FRF debt @ 10% and Corp.FREN has Aud debt @ 15%.

Each party reduces its borrowing cost by 1%. However, it is difficult for most corporations and government borrowers to locate others that want to do an off-setting transaction at the same time and for the same amount. They also face credit risk with others. Under the circumstances, swap deals will be entered into through a bank. In exchange of services to be rendered, bank will take part of the savings involved in the swap. Consequently, the net savings of the swap for Corp. AUST and Corp. FREN will be less than 1%.

Let us assume that spot FRF/AUD exchange rate is 5 FRF per 1 AUD. A deal based on 100 million AUD is executed. In order for swap to work, it is essential that the amount be of the same value. In the above case, 500 million FRF issue is needed to work the swap. Let us further assume that both corporations are raising funds in their own currencies. Corp. FREN, after raising the FRF loan, enters into a swap with bank, which in turn, will allow Corp. AUST to use FRF loan @ 10.20%. Simultaneously, the bank will allow Corp. FREN to use AUD debt @ 15.20%. Thus, effectively both of them will be saving 0.80%. The transactions can be summarised as follows:

**In terms of FRF :**

| Time | Transaction | Corp. FREN | Bank | Corp. AUST |
|---|---|---|---|---|
| 0 | Original Loan | 500 million | - | . |
| | FREN to Bank | (500) million | 500 million | . |
| | Bank to AUST | - | (500) million | 500 million |
| 1 | Interest payments : | | | |
| | Aust to Bank | - | 51 million | (51) million |
| | Bank to FREN | 50 million | (50) million | . |
| | FREN to investor | (50) million | - | . |

**In terms of AUD:**

| Time | Transaction | Corp. FREN | Bank | Corp. AUST |
|---|---|---|---|---|
| 0 | Original Loan | - | - | 100 million |
| 0 | AUST to Bank | - | 100 million | (100) million |
| 0 | Bank to FREN | 100 million | (100) million | - |
| 1 | Interest payments : | | | |
| | Fren to Bank | (15.2) | 15.2 million | - |

| | | | | |
|---|---|---|---|---|
| | | million | | |
| | Bank to AUST | - | (15) million | 15 million |
| | AUST to investor/lender | - | - | (15) million |

The proposed entries for the Corp. FREN will be:
**Initial borrowing :**

| | | |
|---|---|---|
| Cash | 500 ml. | |
| To FRF Loan | | 500 ml. |
| FRF Loan | 500 ml. | |
| To Cash<br>(For FRF Loan passed to intermediary/Swap Bank) | | 500 ml. |
| Cash | 500 ml. | |
| To AUD Loan<br>(For AUD Loan received from intermediary/Swap Bank) | | 500 ml. |
| Interest on AUD Loan | 76 ml. | |
| To Cash<br>(interest payments of 15.2 ml. AUD @ 5 FRF | | 76 ml. |
| Cash<br>To Interest on FRF Loan (int. receipt from Swap Bank) | 50 ml. | 50 ml. |
| Interest on FRF Loan | 50 ml. | |
| To Cash<br>(Int. payment to investor) | | 50 ml. |

In addition to the above entries entered for the purpose of transaction, the fair value of the loan is also likely to change. Therefore, to the extent that the fair value of the loan will be affected on account of currency swap, entries should also be passed, which will be on similar lines as for the interest rate swap. Moreover, at the end of the term of the debt re-exchange of the debt with the swap bank will also be required and this should also be recorded as per the normal principles of accounting.

## Currency options:

In late February, an American Importer anticipates a Yen payment of JPY 100 million to a Japanese supplier sometime in late May. The current USD/JPY spot rate is 0.007739 (which implies that JPY/USD rate of 129.22). A June Yen call option on the Philadelphia Exchange with the strike price of $0.0078 per yen is available for a premium of 0.0108 cents per yen or $ 0.000108 per yen. A contract is for JPY 6.25 million. Premium per contract is therefore : $

0.000108 * 6250000 = $ 675. The firm decides to purchase 16 calls for a total premium of $ 10800. In addition, there is a brokerage fee of $ 20 per contract. Thus, total expenses in buying the options is $ 11120. The firm has, in effect, ensured that its buying rate for yen will not exceed - $0.0078 + $ (11120/100000000) = $ 0.0079112 per yen. The yen depreciates to $ 0.0075 per yen in late May when the payment becomes due. The firm will not exercise the option. It can sell 16 calls in the market, provided the resale value exceeds the brokerage commission it will have to pay. Therefore, price per yen is $ 0.075 + 0.000112 $. If Yen appreciates, then the firm will exercise option. Under the above mentioned circumstances, following entries are suggested.

For purchases irrespective of contract:

| |
|---|
| Purchases |
| To creditor |

Or

| |
|---|
| Fixed asset |
| To Supplier |

When option contract is entered into:

| |
|---|
| Option premium |
| To Cash |

**year end,** the amount of the premium is to be debited to profit and loss account or to fixed asset, as the case may be.

| | |
|---|---|
| P & L | Fixed assets |
| To Option | To Option |
| premium | premium |

However, according to FASB 133, the financial option is to be shown as an asset or liability.

According to para 28(c) —If written option is designated as hedging the variability in cash flows

for a recognised asset or liability, the combination of the hedged item and the written option

provides at least as much potential for favourable cash flows as exposure to un-favourable cash

flows. That test is met if all possible percentage favourable changes in the underlying (from zero

percent to 100 percent) would provide at least as much favourable cash flows as the

unfavourable cash flow that would be incurred from an unfavourable change in the underlying of

the same percentage. Therefore, depend-ing on the value, it will be accounted as asset or

liability. Even IAS 39 clearly states in para 29(d) that _Financial Options are recognised as assets

or liabilities when holder or writer becomes a party to contract.I Thus, options are to be
recognised as asset or liability. The proposed accounting entry is:

| |
|---|
| Options |
| To Unrealised gain |
| To Gain |

Above are the proposed entries for the accounting of forward contract, interest rate swap, currency swap and currency options. It is high time that the Institute of Chartered Accountants of India comes out with the standard for accounting for derivatives.

**Test your understanding**

**What is forward contract?**

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**What is Currency Swap?**

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**What is currency option?**

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## 19.2 TAXATION OF FINANCIAL DERIVATIVES

### INTRODUCTION

Derivatives are primarily risk management tools. More accurately, they are volatility management tools. The ability to assume risk is a function of capital. The basis of the efficient utilization of capital is the netting of risks against each other1. Trading in derivatives has now become an integral part of the global financial market. The past three decades have seen a singular rise in the development and growth of derivatives markets the world over. Trading in futures and options has seen a big rise and time and again, new products have been introduced which are related to this concept. Futures, options and OTC derivatives markets are integral parts

of almost all economies of the world which have reached an advanced stage of development. Such markets are likely to become important part of developing countries as well, helping them to move to the advanced stage with the passage of time.

The Indian government, based on the L.C. Gupta Committee recommendations, has allowed trading in derivatives to begin in India. The Derivatives Bill, passed recently, will give trading on the domestic bourses a new dimension, as index-based trading would finally be permitted, a long-standing demand in the Indian markets. The shares underlying a stock exchange index would be traded as a single unit. The passing of the Derivatives Bill also requires a change in the definition of _securities' in the Securities Contract (Regulation) Act (SCRA), to include the words 'futures' and 'options'. The development of a derivatives market is considered as a prerequisite for the Indian capital market to be globally competitive.

'Derivative' is an instrument whose value depends on its underlying cash or physical asset. Hence it means that the value is derived from the value of the underlying assets like foreign exchange, currency, securities and commodities. It also includes market indices such as the LIBOR, BSE Sensex or benchmark interest rates. The result of a derivative transaction is a transfer or exchange of specified cash flows at defined future points in time. Derivatives include forward, future and option contracts that are of a pre-determined fixed duration, linked for the purpose of contract fulfillment, to the specified value of real or financial asset or to index of securities.

Derivatives are used to hedge against price, currency and interest rate risk. Since derivative instruments do not involve risks, they help redistribute the risk between market participants. Hence, derivatives in this sense are used for risk management. Derivatives can also be used for speculative functions.

## 19.2.1 THE INDIAN LEGAL PERSPECTIVE

Although the focus of the paper is on taxation, it might help to understand some of the legal issues confronting derivative transactions. This section attempts to provide an outline of the legal issues that may arise in a derivative transaction.

### Legal issues - legality and validity:

Some of the broad legal issues include exchange control regulations, the issue of legality and validity of the transaction, questions of enforceability, termination provisions and insolvency issues. The Derivatives Bill which was tabled recently in the parliament will remove some of the ambiguities that exist currently in these areas. The Bill is expected to be an enabling legislation with wide ranging impact on issues of validity and legality of derivative transactions.

### Wager analysis:

A related issue is whether a derivatives transaction can be said to a contract for wager and hence invalid as per the terms of the Indian Contract Act 1872 ("ICA"). However, the law in this area is not very clear. The outcome would be determined on the basis of the facts and circumstances of each case. A contract wherein the element of wagering was merely a subordinate element, and did not constitute the substance of the transaction would be valid and enforceable. However, a transaction may be regarded as a wagering contract if the object was pure speculation or where the primary object of the transaction was speculation. A crucial element in determining whether or not a contract amounts to wager is the intention of parties. Another factor which may also have a bearing is whether the settlement takes place by way of 'netting off' of the differential or by an exchange of the underlying currencies. The former may be held to be speculative in nature.

### Exchange control issues:

The Rupee is not fully convertible on the capital account, though it is moving towards that direction. Hence, Indian resident cannot enter into a derivative contract directly with counterparts overseas. Such transactions have to be channeled through an authorized dealer. Besides this, there are some other exchange control regulations which govern crossborder transactions.

### Termination of transactions:

The Foreign Exchange Dealers' Association of India (FEDAI) has recommended the adoption of the International Swap Dealers' Association's (ISDA) Agreement. Hence most of the issues of termination and the ancillary issues arising out of termination are governed by the standard terms and conditions of the ISDA Agreement. The events of default under the ISDA are quite stringent and these have given rise to some concerns. One such concern relates to the ability of the overseas party to terminate all transactions (—automatic terminationl) under an agreement relying on the default of the Indian party.

### Insolvency issues:

The insolvency issues include the question of preference of payments upon insolvency proceedings being initiated. Another issue that may arise is whether a payment made or security delivered once bankruptcy proceedings have been initiated is valid. Such payments are generally valid unless they are fraudulent payments made to defeat valid claims under liquidation proceedings. Another concern related to insolvency risk is whether or not setting off of exposures would be permitted. A creditor claiming to prove a debt against an insolvent company in liquidation is entitled to set off its related claims. Even cross claims arising out of two separate contracts can be set off, if the two contracts are sufficiently connected and form part of the same transaction.

## 19.2.2 TAXATION OF FINANCIAL DERIVATIVES

Taxation of derivatives is perhaps as complex an exercise as the transaction itself. A number of issues arise out of these transactions to which there are no well defined answers. The legal analysis of derivatives is fundamental to understanding its taxation. Several questions arise about characterization of income, treatment of the derivative and the underlying transaction etc. The issues get more intricate in the context of cross-border transactions. Characterization of income assumes greater importance as most of the tax treaties exempt 'business income' or 'other income' from taxation in the source country unless there is a Permanent Establishment. The lack of international consensus on taxation could lead to multiple taxation of a derivative transaction.

**Primary Liability**

1. "Tax aspects of derivative financial instruments" IFA, Cahiers vol. LXXXI, 1995 2. "Statement of Recommended Accounting Practice: Derivatives", British Bankers' Association, 1995 3. "Derivatives and Other Financial Instruments" Discussion paper on Accounting Standards Board, July 1996 4. "Taxation of Global Trading of Financial Instruments" Draft OECD Commentaries, 1997 5. "The Taxation of Derivatives" by David Southern, British Tax Review, 1998

IFA has published a comparative study of taxation of derivatives in about 29 countries. As per the study, there are three basic approaches to taxation of derivatives :

(1) Decomposition principle - under which every derivative transaction is analyzed into a number of cash flows, each of which can be separately valued and taxed (2) Separate Transaction principle - under which each derivative contract is looked at in isolation to establish an overall return on investment (3) Linked approach - under which the related transactions are clubbed together to analyze the overall profit of the entire transaction.

There seems to be a general acceptance of the theory that the taxation of derivative financial instruments (popularly known as DFIs) is not to be determined by reference to the tax treatment of the underlying instrument to which the derivative relates. Most countries seem to have adopted the second i.e. separate transaction principle.

## 19.2.3 Key issues in Taxation of a Derivative transaction

1) Characterization of income i.e. business income or interest

2) Determination of income i.e. timing and cash flow

3) Withholding tax implications

Unlike traditional debt and equity securities and foreign currency, derivative financial instruments do not involve a return on initial investment. In view of this peculiarity, the characterization of income is of great significance in order to determine its taxability. Whether the income arising from a derivative transaction can be regarded as interest, has been dealt with in the 1994 Report of the OECD on "Taxation of New Financial Instruments". In 1995, Paragraph 21.1 was added to the OECD Commentary on Article 11 which made it abundantly clear that in the absence of underlying debt, the payment for a financial instrument will not be regarded as 'interest'. This was made subject to 'substance over form' rule and 'abuse of rights' principle. In general, the income arising from a derivative transaction should be regarded as 'ordinary income'. If a derivative transaction is entered into in the ordinary course of business, it should be considered as 'business income' otherwise, it should be characterized as 'other income'. In a cross-border transaction where a tax treaty applies, under both these situations, income arising from a derivative transaction should not be taxable in the country of source unless there exists a Permanent Establishment.

The next issue arises as to when the income should be taxed. There are several points at which the income from a derivative transaction may arise. Initially, there may be a premium paid. In many transactions, there will be intermediate value dates on which interest or dividend becomes payable on the underlying securities. Further, many contracts are 'marked to market" which means that their value is adjusted in view of the market value of the underlying asset on a periodic basis. Finally, at the maturity, there is an ultimate settlement of the difference. When and how to tax these cash flows may to some extend depend upon the method of accounting adopted by the tax payer.

Since in most of the cross-border transactions, derivative income may not be taxed in the absence of a PE, it is crucial that there are no withholding taxes leviable on such income. However, this will depend upon the domestic tax law provisions in each country and the provisions of relevant tax treaties applicable to such companies.

We will now examine how these issues are addressed under our local income tax law.

## 19.3 Taxation of Derivatives in India

Derivative transactions are still in nascent stage in India and their tax implications are still to be tested by the Indian revenue authorities. There are no precedents directly on the subject. Margins in a swap transaction are extremely narrow. Therefore, the imposition of taxes by the country of the payer substantially alters the profitability of a swap.

**General provision under the Income tax Act:**

Indian residents are subject to tax on their worldwide income, non-residents on the other hand are taxed only on income received by them in India, or income that accrues or arises to them in India2. Further, under certain conditions, income can be "deemed to accrue or arise in India" and thereby be subject to tax in India3. Generally, the entire tax payable by a nonresident in respect of income earned in India is liable to be withheld at source.

**Taxation under the I-T Act**

Section 9 of the I-T Act covers situations under which income which can be —deemed to accrue or arise in India". Under Section 9(1)(i) of the I-T Act, all income accruing or arising, through or from any business connection/property/asset or source of income in India, is deemed to accrue or arise in India4. Only such part of the income as is reasonably attributable to the operations carried out in India can be deemed to accrue or arise in India.

Section 5 of the Income Tax Act, 1961 3 Section 9 of the Income Tax Act, 1961 4 Section 9(1)(i) reads as follows:

"All income accruing or arising, whether directly or indirectly, through or from any business connection in India, or through or from any property in India, or through or from any asset or source of income in India, or through the transfer of a capital asset situated in India is deemed to accrue or arise in India"

Explanation (a) to section 9 reads as under: "For the purpose of this clause – in the case of a business of which all the operations are not carried out in India, the income of the business deemed under this clause to accrue or arise in India shall be only such part of the income as is reasonably attributed to the operations carried out in India."

Unlike in the United Kingdom, the Indian tax laws do not specifically distinguish between "doing business in India" and "doing business with India". The term "business connection" which is crucial to determination of taxable business income in India, is not statutorily defined. Therefore, this term is to be understood based on interpretation provided by courts. In general, it can be interpreted as a continuous relationship between a business carried on by a non-resident entity, which yields profits or gains and some activity (in India) which contributes directly or indirectly to the earning of these profits or gains.

Whether payments under derivative transactions would constitute "Income deemed to accrue or arise in India" is a question which can be dealt with only qua facts of a specific transaction. The I-T Act does not specifically deal with the tax incidence of income flows arising out of a derivative transaction. Indian courts have also not analyzed the taxation of such income. Though there are no direct cases on the point, courts have opined on the taxability of profits/losses arising to an assessee merely due to the appreciation or depreciation in the value of foreign currency held by it. The position adopted by courts has been that such profits/losses would ordinarily be trading profit/losses if the foreign currency is held by the assessee in revenue account or as a trading asset or as part of circulating capital. If, on the other hand, the foreign currency is held by the assessee as a capital asset or as fixed capital, such profit or loss would be of capital nature. (Sutlej Cotten Mills V. CIT, (1979) 116 ITR 1, State Bank of Travancore v. CIT, (1986) 158 ITR 102).

Section 10(15)(iv) of the I-T Act exempts certain types interest payments from taxation in India. The Finance Act, 1999 has enlarged the scope of the word _interest'. Now, interest includes hedging transaction charges on account of currency fluctuation. This would mean that any payment made for hedging against foreign currency rate fluctuations in respect of foreign currency debt obligation may be exempt from taxation in India.

**Tax Treaty Provisions:**

India has tax treaties with a number of countries. Indian tax law is unique as it statutorily offers a tax payer choice between the provisions of the treaty and the domestic tax law under Section 90

(2) of the I-T Act6. The effect of this section is that, a tax payer may opt for the treaty or I-T Act, whichever is more beneficial.

Most comprehensive treaties give the country of source the right to tax business income only if the recipient has a Permanent Establishment (PE) in the country of source. PE is a much narrower concept than "business connection". Therefore, many foreign parties, which may have a "business connection" in India by virtue of having the counter party in India and source of income in India, may not have a PE in India. This distinction is so crucial that the entire income, which could be taxable under the first concept, could be tax exempt under the 6 Section 90 (2) of the I-T Act reads as follows: "Where the Central Government has entered into an agreement with the Government of any country outside India under sub section (1) for granting relief of tax, or as the case may be, avoidance of double taxation , then, in relation to the assessee to whom such agreement applies, the provisions of this Act shall apply to the extent they are more beneficial to the beneficiary."

In the absence of a permanent establishment in India, the business income arising out of the derivative transactions made by the Indian payer, will not be subject to tax in India.

Even if a PE is found to exist, only such part of the business income, which is attributable to the permanent establishment, can be taxable in India. Such income is taxable on 'net' basis after deduction of certain expenses. While foreign companies are taxed at the rate of 48 %, domestic companies are taxed at the rate of 35% on such business profits. The Nondiscrimination Article in some of the tax treaties may help reduce the tax incidence from 48% to 35%.7

For giving effect to the treaty provisions, reliance will have to be placed by the Indian counterparty on the payee representations. The payee may have to provide evidence that it qualifies for the relevant exemption from withholding taxes. The Indian counterparty can withhold the tax at the rates in force.8

Non-residents are eligible for applying for an advance ruling which is available on an existing or a proposed transaction, on questions of law or facts. These rulings are binding upon the applicant and the tax authorities, in respect of that applicant. Such a ruling may help the foreign counter party to determine the relevant tax implications in India.

**Withholding Tax:**

In a cross-border DFI transaction, withholding tax is a crucial question as the traders want their cash flows free of taxes. In general, withholding tax is levied on interest, dividend or royalty payments. Most countries have regarded payments under derivative contracts as falling outside 'interest' and 'dividend' articles as they do not reflect the true return on capital. The same principle should apply to payments of differences on futures contracts, swap fees and premiums on options. Most of these payments fall within 'business profits' or 'other income' articles and therefore, are remitted gross, free of withholding taxes. The taxation is determined in the country of residence.

In India, the position is slightly different. Section 195(1) of the I-T Act entrusts the payer with the liability to withhold tax on certain payments being made to a foreign recipient10.There has been a recent advance ruling in the case of a French bank, which has been denied the benefits of nondiscrimination article under India-French treaty for reduction of tax rate. (Advance Ruling Application No. P – 16 of 1998, In re), (1999) 102 TAXMAN 377 (AAR – New Delhi) 8 " Rate or Rates in force " has been defined under Section 2(37A) to include: "...... (iii) for the purposes

of deduction of tax under section 195, the rate or rates of income tax specified in this behalf in the Finance Act of the relevant year or the rate or rates of tax specified in an agreement entered into by the Central Government under section 90, whichever is applicable by virtue of the provisions of section 90......." 9 'The Taxation of Derivative', British Tax Review, 1998 10 The section reads as follows:

"Any person responsible for paying to a non-resident, not being a company, or to a foreign company, any interest (not being interest on securities) or any other sum chargeable under the provisions of the I-T Act, not being arises with respect to withholdings under section 195 that whether the payer has to deduct tax on the gross amount of payments due to the non-resident, or on the income or profit element received by the non-resident. The Supreme Court has authoritatively settled this issue in the case of Transmission Corporation of AP Ltd. V. CIT11. The Apex court has held that the scheme under section 195 of the ITA applies not only to the amounts that bear an element of income or profit, but also to gross sums, the whole of which may not be income or profit of the recipient.

In order to obtain an exemption from withholding any tax, or for withholding tax at a lower rate, the payer/payee will have to file an application with the Assessing Officer to determine the appropriate portion of the sum that should be chargeable to tax12. However, it should be noted that a certificate granted in this regard is only provisional. Final tax liability is ascertained upon regular assessment after a tax return is filed (if necessary)13.

It is pertinent to note that in case of a banking company, exemption from withholding taxes is available only if the payments (not classified as interest on securities or dividend) are received by the branch operating in India, on its own account and are not received on behalf of the head office or any other branch situated outside India.

Thus, the Indian payer making payments to overseas parties under a derivative transaction is generally liable to withhold tax at source. The procedure for obtaining this lower tax withholding certificate has been recently simplified. Now, based on a Chartered Accountant's certificate, the Indian payer can remit the payment after withholding tax at the lower rate applicable under the treaty or without withholding any tax, as the case may be. However, it has to submit an undertaking that it shall undertake to pay the shortfall in tax, interest or penalty, which are payable in accordance with the provisions of I-T Act.

**Gross-up of Tax:**

Under the terms of the ISDA Master Agreement, the payer has to bear the burden of withholding taxes, where the tax is payable because of a connection with its chosen tax jurisdiction (i.e.: India). The burden to bear the taxes falls upon the payee only in limited circumstances where the payee has made a representation which is not true at the time it is made or which becomes untrue as a result of subsequent events or where the payee fails to conform to a provision in the ISDA Master Agreement requiring performance of a tax related obligation.

In India, however the payer will have to comply with the provisions of section 195A of the I-T Act read together with circular number 370 issued by the Central Board of Direct Taxes. These require that when the payer bears the income tax liability, the calculation of tax to be income chargeable under the head `Salaries' shall at the time of credit of such income to the account of the payee or at the time of payment thereof in cash, or by the issue of a cheque or draft or by any other mode, whichever is earlier, deduct income tax thereon at the rates in force." 11 239 ITR 587. 12 Sections 195(2),(3), and 197 of the ITA. 13 Section 197 of the I-T Act. withheld at source should be made not with reference to the 'net-of-tax' amount payable to the non-resident payee, but should be made with reference to the gross amount. This provision may further affect the profitability of a derivative transaction in India.

**Tax Implications on Swaps:**

Taxation of swap payments is fairly complicated. The issue involved is one of characterization of the settlement amount. The characterization of the amount could be either business income or interest income. There is a strong case for the swap payment to constitute business income in the hands of the non-resident recipient as against interest income or other income.

Under the I-T Act, the term "interest" is defined under section 2(28A) to mean interest payable in any manner in respect of moneys borrowed or debt incurred (including a deposit, claim or other similar right or obligation) and includes any service fee or other charge in respect of the moneys borrowed or debt incurred or in respect of any credit facility which has not been utilized.

In a swap transaction, there is no money borrowed or debt incurred. The principal of a swap deal is the notional amount and the adjustment takes place between the bank and the counterparty in respect of the amounts payable by them. Only the net amount changes hands. Therefore, such amounts should qualify as trading income. However, in a synthetic transaction, where the deal is structured in a manner where there is a debt incurred and the payment is made in respect of debt incurred, such payment could be regarded as 'interest'. In the Indian context, such a situation may be the practical reality faced by the Indian corporates who are forced to enter into synthetic transactions. The consequences may be different in a cross-border transaction, especially where the non-resident counterparty is from a treaty jurisdiction.

**Article 11(3) of the OECD Model Convention defines interest as :**

"The term interest as used in this Article means income from debt-claim of every kind, whether or not secured by mortgage and whether or not carrying a right to participate in the debtor's profits, and in particular, income from government securities and income from bonds and debentures, including premiums and prizes attaching to such securities, bonds or debentures. Penalty charges for late payment shall not be regarded as interest for the purpose of this article."

Thus, even the definition of OECD Model Convention (OECD MC) lays emphasis on the debt-claim. The commentary to OECD MC also supports the above argument14.14 Paragraph 21.1 on financial derivatives of the commentary to the OECD MC states that,

"The definition of interest in the first sentence of paragraph 3 does not normally apply to payments made under certain kinds of nontraditional financial instruments where there is no underlying debt (for example, interest rate swaps). However, the definition will apply to the extent that a loan is considered to exist under a 'substance over form' rule, an 'abuse of rights' principle, or any similar doctrine."

Thus it can be concluded that, as long as the underlying 'debt-claim' remains purely hypothetical, the equalization payment is not interest. The fact that the swap was created, to secure the payments on a loan does not change the payment into interest. However, if one party pays a
lumpsum amount to the other and the same is repaid over the course of the swap (an off-market swap), the return and equalization payments could be seen to contain a loan element.15

If these amounts were to be treated as interest, they may attract a withholding tax in India at the rate of 20% on the gross amount16. This rate could be reduced further depending upon the tax treaty provisions. If a foreign company earns any business income that is deemed to accrue or arise in India, it would be liable to be taxed at the current applicable rate of 48% on its net business income.

## 19.4 Summary

- Derivatives are financial instruments that derive their value from changes in benchmark based on stock prices, interest rates, mortgage rates, currency rates, commodity prices or some other agreed upon base. Derivative Financial Instruments (DFIs) can be either on the balance sheet or off the balance sheet and include : options contract, interest rate swap, interest rate floors, interest rate collars, forward contract, futures, etc.

- According to International Accounting Standard (IAS) 39 para 10, —a derivative is a financial instrument : whose value changes in response to the change in a specified interest rate, security price, commodity price, foreign exchange rate, index of prices or rates, a credit rating or credit index or similar variable (sometimes called the underlying); that requires no initial net investment or little initial net investment relative to other types of contracts that have a similar response to changes in market conditions; and that is settled at a future date.‖

- 'Derivative' is an instrument whose value depends on its underlying cash or physical asset. Hence it means that the value is derived from the value of the underlying assets like foreign exchange, currency, securities and commodities

- Taxation of swap payments is fairly complicated. The issue involved is one of characterization of the settlement amount. The characterization of the amount could be either business income or interest income. There is a strong case for the swap payment to constitute business income in the hands of the non-resident recipient as against interest income or other income.

## 19.5 Self - Assessment Questions

1. Explain the Accounting process in Financial Derivatives.

2. Write a short note on the Taxation of Financial Derivatives.

3. List the Legal issues that confront the Derivative Transactions.

4. What are the major issues in the taxation of derivative transactions?

5. What are the tax implications on SWAPS?

## 19.6 Suggested Readings


1. Kolb,R.W. &Overdhal,J.A., Financial Derivatives, John Wiley & Sons, Inc.

2. Kumar, S.S.S., Financial Derivatives, PHI Learning Private Limited.

3. Parasuraman,N.R., Fundamentals of Financial Derivatives, Wiley India Pvt. Ltd.

4. Gupta, S.L., Financial Derivatives, PHI Private Limited.

## Unit 20- Derivatives Regulation Framework in India: Policy, Types, Relevance, Merits and Shortcomings

### Unit Structure

## 20.0 Unit Objectives

This unit includes the policies and regulations, framework, types, relevance, merits and limitations.

## 20.1 Regulatory Framework for Derivatives Trading in India

With the amendment in the definition of "securities" under SC(R)A (to include derivative contracts in the definition of securities), derivatives trading takes place under the provisions of the Securities Contracts (Regulation) Act, 1956 and the Securities and Exchange Board of IndiaAct,1992.

Dr. L.C Gupta Committee constituted by SEBI had laid down the regulatory framework for derivative trading in India. SEBI has also framed suggestive bye-law for Derivative Exchanges/Segments and their Clearing Corporation/House which lays down the provisions for trading and settlement of derivative contracts. The Rules, Bye-laws & Regulations of the Derivative Segment of the Exchanges and their Clearing Corporation/House have to be framed in line with the suggestive Bye-laws. SEBI has also laid the eligibility conditions for Derivative Exchange/Segment and its Clearing Corporation/House. The eligibility conditions have been framed to ensure that Derivative Exchange/Segment & Clearing Corporation/House provide a transparent trading environment, safety & integrity and provide facilities for redressal of investor

grievances. Some of the important eligibility conditions are -

- Derivative trading to take place through an online screen based Trading System.
- The Derivatives Exchange/Segment shall have online surveillance capability to monitor positions, prices, and volumes on a real time basis to deter market manipulation.

- The Derivatives Exchange/ Segment should have arrangements for dissemination of information about trades, quantities and quotes on a real time basis through atleast two information vending networks, which are easily accessible to investors across the country.
- The Derivatives Exchange/Segment should have arbitration and investor grievances redressal mechanism operative from all the four areas / regions of the country.
- The Derivatives Exchange/Segment should have satisfactory system of monitoring investor complaints and preventing irregularities in trading.
- The Derivative Segment of the Exchange would have a separate Investor Protection Fund.
- The Clearing Corporation/House shall perform full novation, i.e. the Clearing Corporation/House shall interpose itself between both legs of every trade, becoming the legal counterparty to both or alternatively should provide an unconditional guarantee for settlement for all trades
- The Clearing Corporation/House shall have the capacity to monitor the overall position of Members across both derivatives market and the underlying securities market for those Members who are participating in both.
- The level of initial margin on Index Futures Contracts shall be related to the risk of loss on the position. The concept of value-at-risk shall be used in calculating required level of initial margins. The initial margins should be large enough to cover the one-day loss that can be encountered on the position on 99% of the days.
- The Clearing Corporation/House shall establish facilities for electronic funds transfer (EFT) for swift movement of margin payments.
- In the event of a Member defaulting in meeting its liabilities, the Clearing Corporation/House shall transfer client positions and assets to another solvent Member or close-out all open positions.
- The Clearing Corporation/House should have capabilities to segregate initial margins deposited by Clearing Members for trades on their own account and on account of his client. The Clearing Corporation/House shall hold the clients' margin money in trust for the client purposes only and should not allow its diversion for any other purpose.
- The Clearing Corporation/House shall have a separate Trade Guarantee Fund for the Trades executed on Derivative Exchange / Segment.

Presently, SEBI has permitted Derivative Trading on the Derivative Segment of BSE and the F&O Segment of NS.

## 20.2 Types of Membership in the derivatives market in India

The various types of membership in the derivatives market are

- Trading Member (TM)- A TM is a member of the derivatives exchange and can trade on his own behalf and on behalf of his clients.

- Clearing Member (CM)- These members are permitted to settle their own trades as well as the trades of the other non - clearing members known as Trading Members who have agreed to settle the trades through them.

- Self-clearing Member (SCM)- A SCM are those clearing members who can clear and settle their own trades only .

- Professional Clearing Member (PCM)- PCM is a CM who is not a TM. Typically, banks or custodians could become a PCM and clear and settle for TMs.

Details of the eligibility criteria for membership on the F & O segment are provided in Tables. The TM-CM and the PCM are required to bring in additional security deposit in respect of every TM whose trades they undertake to clear and settle. Besides this, trading members are required to have qualified users and sales persons, who have passed a certification programme approved by SEBI.

Table gives the requirements for professional clearing membership. As mentioned earlier, anybody interested in taking membership of F&O segment is required to take membership of ―CM and F&O segment‖ or ―CM, WDM and F&O segment‖. An existing member of M segment can also take membership of F&O segment. A trading member can also be a clearing member by meeting additional requirements. There can also be only clearing members.

- TABLE: ELIGIBILITY CRITERIA FOR MEMBERSHIP ON F & O SEGMENT

| Particulars (all values in Rs. Lakh | CM and F &Osegment | CM, WDM and F & O segment |
|---|---|---|
| Net worth1 | 100 | 200 |
| Interest free security deposit (IFSD)2 | 125 | 275 |
| Collateral security deposit (CSD)3 | 25 | 25 |
| Annual subscription | 1 | 2 |

1: No additional net worth is required for self-clearing members. However, a net worth of Rs. 300 Lakh is required for TM-CM and PCM.

2 & 3: Additional Rs.25 Lakh is required for clearing membership (SCM, TM-CM). In addition, the clearing member is required to bring in IFSD of Rs.2 Lakh and CSD of Rs.8 lakh per trading member he undertakes to clear and settle.

TABLE. REQUIREMENTS FOR PROFESSIONAL CLEARING MEMBERSHIP

| Particulars (all values in Rs Lakh | F & O segment | CM & F&O segment |
|---|---|---|
| Eligibility | Trading members of | Trading members |

| | | |
|---|---|---|
| | NSE/SEBI registered custodians/recognized banks | NSE/SEBI registered custodians/recognized banks |
| Networth | 300 | 300 |
| Interest free security deposit (IFSD | 25 | 34 |
| Collateral security deposit | 25 | 50 |
| Annual subscription | Nil | 2.5 |

Note: The PCM is required to bring in IFSD of Rs. 2 Lakh and CSD of Rs. 8 Lakh per trading member whose trades he undertakes to clear and settle in the F & O segment.

The derivatives member is required to adhere to the code of conduct specified under the SEBI Broker Sub-Broker regulations. The stipulations laid down by SEBI on the regulation of sales practices are:

**Sales Personnel:** The derivatives exchange recognizes the persons recommended by the Trading Member and only such persons are authorized to act as sales personnel of the TM. These persons who represent the TM are known as Authorized Persons.

**Know-your-client:** The member is required to get the Know-your client form filled by every one of client.

**Risk disclosure document:** The derivatives member must educate his client on the risks of derivatives by providing a copy of the Risk disclosure document to the client.

**Member-client agreement**: The Member is also required to enter into the Member-client agreement with all his clients.

## 20.3 Eligibility of indices and stocks for futures and option trading

In the beginning futures and options were permitted only on S&P Nifty and BSE Sensex. Subsequently, sectoral indices were also permitted for derivatives trading subject to fulfilling the eligibility criteria. Derivative contracts may be permitted on an index of 80% of the index constituents are individually eligible for derivatives trading. However, no single ineligible stock in the index shall have a weightage of more than 5% in the index. The index is required to fulfill the eligibility criteria even after derivatives trading on the index have begun. If the index does not fulfill the criteria for 3 consecutive months, then derivative contracts on such index would be discontinued. By its very nature, index cannot be delivered on maturity of the Index futures or Index option contract, therefore, these contracts are essentially cash settled on Expiry.

A stock on which stock option and single stock future contracts can be introduced is required to fulfill the following broad eligibility criteria:

1. The stock should be amongst the top 200 scrips, on the basis of average market capitalization during the last six months and the average free float market capitalization should not beless than Rs.750 crore. The free float market capitalization means the non-promoters holding in the stock.

2. The stock should be amongst the top 200 scrips on the basis of average daily volume (in value terms), during the last six months. Further, the average daily volume should not be less than Rs5 crore in the underlying cash market.

3. The stock should be traded on at least 90% of the trading days in the last six months, with the exception of cases in which a stock is unable to trade due to corporate actions like demergers etc.

4. The non-promoter holding in the company should be at least 30%.

5. The ratio of the daily volatility of the stock vis-à-vis the daily volatility of the index (either BSE-30 Sensex or S&P CNX Nifty) should not be more than 4, at any time during the previous six months. For this purpose the volatility would be computed as per the exponentially weighted moving average (EWMA) formula.

6. The stock on which option contracts are permitted to be traded on one derivative exchange/segment would also be permitted to trade on other should not be less than Rs. 2 Lakh at the time of introducing the contract in the market. In February 2004, the Exchanges were advised to re-align the contracts sizes of existing derivative contracts to Rs. 2 Lakh. Subsequently, the Exchanges were authorized to align the contracts sizes as and when required in line with the methodology prescribed by SEBI

## 20.4 Measures specified by SEBI to protect the rights of investor in Derivatives Market

The measures specified by SEBI include:

- Investor's money has to be kept, separate at all levels and is permitted to be used only against the liability of the investor and is not available to the trading member or clearing member or even any other investor.

- The Trading Member is required to provide every investor with a risk disclosure document that will disclose the risks associated with the derivatives trading so that investors can take a conscious decision to trade in derivatives.

- Investor would get the contract note duly time stamped for receipt of the order and execution of the order. The order will be executed with the identity of the client and without client ID order will not be accepted by the system. The investor could also demand the trade confirmation slip with his ID in support of the contract note. This will protect him from the risk of price favor, if any, extended by the Member.

- In the derivative markets all money paid by the Investor towards margins on all open positions is kept in trust with the Clearing

House/Clearing Corporation and in the event of default of the Trading or Clearing Member the amounts paid by the client towards margins are segregated and not utilized towards the default of the member. However, in the event of a default of a member, losses suffered by the Investor, if any, on settled/closed out position are compensated from the Investor Protection Fund, as per the rules, bye-laws and regulations of the derivative segment of the exchanges.

- The Exchanges are required to set up arbitration and investor grievances redressal mechanism operative from all the four areas/regions of the country.

## 20.5 Rationale Behind Derivatives

When the L C Gupta Committee recommended the introduction of derivatives in India, the brokers of BSE opposed its introduction. And the senior regulators of BSE felt strongly that derivatives were going to introduce just because of the experience of some bright _boys' who had derivative exchanges/segments.

A stock can be included for derivatives trading as soon as it becomes eligible. However, if the stock does not fulfill the eligibility criteria for 3 consecutive months after being admitted to derivatives trading, then derivative contracts on such a stock would be discontinued.

### 20.5.1 Minimum size of derivatives contract

The Standing Committee on Finance, a Parliamentary Committee, at the time of recommending amendment to Securities Contract (Regulation) Act, 1956 had recommended that the minimum contract size of derivative contracts traded in the Indian markets should be pegged not below Rs.2 Lakh. Based on this recommendation SEBI has specified that the value of a derivative contract gone to Wharton and returned insistent on applying what they had learnt there instead of listening to the counsel of their elders and betters who know India and what would work in it. Even the NSE brokers threatened to withdrew their initial deposits. But the MD of NSE, Dr. R H Patil pacified the brokers by saying that with the introduction of derivatives trading in the NSE, their sagging future will undergo a sea change.

Therefore, the professionally managed NSE took the opposite view, pressing for the early introduction of derivatives for which it had prepared assiduously and meticulously. The BSE brokers used every means to maintain inefficient, opaque Badla system by arguing that it is not the right time to introduce derivatives trading in India, as the market is not fully efficient. So, first of all, we should understand what is Badla and how are derivatives superior to Badla:

## 20.5.2 Meaning of Badla

The Badla system as prevailed in the Indian capital market, prior to ban by SEBI in December 1993, was a unique system. The term _Badla' denotes the system whereby the buyers or sellers of shares may be allowed to postpone the payment of money, or delivery of the shares,as the case may be, in return for paying or receiving a certain amount of money. It is also known as carry forward trading.

For example, on January 2, A buys the share of company X at a price of Rs. 100/- A is required to pay Rs. 100 to take the delivery of share on the settlement day, i.e., 15th January. On that day, the price of the share is still Rs. 100/-. Instead of paying Rs. 100, he informs his broker that he would like to carry forward the transaction to the next settlement date ending on January 30. The broker locates a seller who is also willing to carry forward the transaction, i.e., who does not want payment of the share price on the 15th. In return for agreeing to postpone the receipt of money from January 15th till 30th, the seller levies charges on the buyer. This charge is known as a Badla. Essentially Badla is a form of interest on the postponed payment to be made by A.

Suppose; the prevailing Badla rate is 4 percent per month. A, therefore pays the seller Rs. 2 per share being the Badla charge for half a month. In this example, it is assumed that there is no change in the prices of shares on the settlement date. Under the Badla system if the share as appreciated, the seller has to pay the buyer the amount of appreciation. Of course he would separately receive from the buyer the Badla charge.

The **strength** of Badla system were:

1. In India, there are restrictions on bank lending against shares. As a result, the liquidity of the stock market is lower than in other countries where bank land liberally against the security of shares. In such an environment, Badla provided a system of financing share transactions and thereby promoted the flow of funds into the secondary market, making for better price discovery and lower transaction costs.

2. It had the merit of providing liquidity with narrow spreads between the _buy' and _sell' quotes.

This difference was very narrow ranging from one fourth of one percent to two percent in comparison to the scrips in which Badla facility was not available, where it varied between 5 to 10 percent.

3. It increased the volume of trading resulting in a decrease in the spread between buy-sell quotes.

4. It was well-established system; besides, the brokers and investors were well conversant with it.

The **weaknesses** of Badla system were:

1. Sometimes even investors with inadequate funds to pay or shares to deliver were attracted to speculate, usually leading to speculation in the market; according to a study conducted

by Capital Market Research and Development (CMRD), the liquidity provided by the speculators involved in Badla was not necessarily genuine liquidity.

2. On an average around 30-40 percent of the volume was accounted for by delivery and payment while the rest was carried forward.

3. Unhealthy speculation sometimes leads to payment problems which were many times followed by closure of the markets.

4. While Badla allows speculation, it does not perform the information function. Details regarding volume, rates of Badla charges, open positions etc. were totally absent in the traditional Badla system. This made it susceptible to manipulation. The zero margin requirements also meant that trading volume could be increased easily by manipulators having little or no capital base. The revised carry forward system provided data on several parameters,

but still didn't publicize the Badla charges, which may vary from seller to seller.

### 20.5.3 Badla v/s futures

In fact, a Badla transaction is identical to a spot market transaction in shares financed by lending against the security of shares while the futures contracts are those contracts in which agreement is made today for a transaction that will take place at a future date. Having established the precise nature of Badla, the comparison with futures trading can be made as follows:

**Similarities**

a) Badla and futures, both allow speculation without paying the full price.

b) Badla and futures, both perform the liquidity function by enhancing the liquidity of the market, since they attract speculative volume.

**Differences**

a) In futures trading, the price for future delivery is defined in advance. In Badla, the price ultimately paid, inclusive of Badla charges, is indeterminate and becomes known only when the transaction is fully concluded. The Badla charges changes from time to time.

b) In the futures trading system, the futures trade is for a specified period defined in advance. In Badla, the period of transaction is undefined, as a transaction can be carried forward indefinitely from settlement to settlement, provided a willing counter party can be found.

c) In the Badla system, no margins were required and hence the scope for speculation was theoretically unlimited. In practice, the only limit on speculative volume was the risk perception

of seller and broker with respect to the buyer's credit worthiness. In futures trading, there is inevitably a deposit on margin requirement, usually ranging from 5 to 15 percent of the transaction value. However, in the revised Badla system, margins were payable.

d) As the Badla system has an indeterminate final price. This means it is not possible to hedge using the Badla transactions since the relationship between the spot price and the future price is uncertain. But in futures, the relationship between future and spot price is certain, so it performs the hedging or price stabilization function.

## 20.5.4 Options v/s Badla

To fully appreciate the working of derivatives as against Badla, a comparative analysis of options and Badla is also desirable. To facilitate this, the silent features in comparative manner are given below:

**I) Carrying forward the transaction**

In Badla, all net positions at the end of the settlement period can be carried forward and members pay or receive Badla charges while the option contract enables the buyer to close his position at any time till the maturity date but carrying forward the position with same option contract is not possible.

**ii) Financing mechanism**

Badla financiers provide the finance to members with net bought positions; usually buyers pay the Badla charges to short sellers. In the option contract, no such financing mechanism exists.

**iii) Hedging**

Options contract can be used for hedging purposes even when the future cash flows are unknown to the holder of the option because it gives the right to holder to exercise the contract rather than obligation while Badla contracts can't be used for hedging purposes. Afteranalyzing the above points, it is clear that Badla only leads to speculation activities in the market while the derivatives perform the function of price discovery and risk management. It is also true that our market comes under the semi- efficient category with the introduction of depositories, on-line trading, increase in mutual fund activity and foreign portfolio investors, but even then it seems that the stage was right for the introduction of derivatives trading. Therefore, when derivatives had become the standardized key to unbundling the risk in banking, investment, capital and insurance market around the world, it was Inevitable that we would also need to established derivatives market in India. In a globalize world, there was no other choice.

Hence, it is clear that derivatives have been introduced in the Indian market in the place of Badla to continue its advantages and to avoid its disadvantages. In the derivatives market, the major participants are hedgers; speculators and arbitrageurs who bring efficiency and liquidity in the market. But it is not necessary that the liquidity brought by speculators is genuine liquidity. Unhealthy and undesirable bubbles created by the speculator may crash the market. It is also true that introduction of derivatives contracts in India has not been very old (as it is approximately 4 years old) but even then it is not short run when the notional trading volumes in derivatives contracts are much more than ash market. The derivatives reported a total trading volume (notional) of Rs.2,130,649 crore during the year 2003-04 as against Rs.439,869 crore in 2002-03, a rise of more than 300 percent in the past one year.

Derivatives are useful instruments that have numerous applications but using them without an understanding of their nuances and behavior can lead to unanticipated risk. And as it is rightly said that don't use theory unless you understand the principles. Use whatever you learn. Therefore, it is the right time to revisit the status and issues relevant for derivatives market in India.

Once more, we need to understand where we have reached, what we have achieved and where we go next.

**<u>Test your understanding</u>**

**What is badla system?**

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**Differences between Badla and Options**

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## 20.6 Relevance

**Why Derivatives are important?**

The uses of derivative instruments are generally attributed to:

i. Risk Sharing Derivatives are mainly used to hedge risk associated with the underlying asset to the willing parties to take risk. The risk comes from several sources and is unavoidable. Derivatives are mainly intended to reduce the risks through transferring, spreading, etc. to the third parties who are risk seekers. The reducible risks include business risk, market risk, interest rate risk, inflation risk, currency risk/exchange rate risk, political risk, credit risk, weather risk, legal and regulatory risks, operational risks, valuation risks, etc. These risks can be reduced in different ways such as,

ii. By selling the source of it

iii. By diversification

III.By buying insurance against losses

(i) Implementation of Asset allocation Decisions Derivatives are useful in implementing the asset allocation strategies on account of their property of low cost of diversification and leverage.

(ii) Information gathering Derivative markets affect the information structure of the financial system. The economic benefit of the information is that the potential imbalances can be visualized more easily by the higher implied volatilities.

(iii)Price discovery and Liquidity Derivative markets offer liquidity in their transactions. Futures and forwards markets are the important source of price information.

## 20.7 Merits

**Merits of Derivatives are:**

Derivatives usually perform the following functions.

**1) Price discovery of the underlying asset:** Price discovery is a method of determining the price for a specific commodity or security through basic supply and demand factors related to the market. Price discovery is the general process used in determining the spot price. These prices are dependent upon market conditions affecting supply and demand. For example, if the demand for a particular commodity is higher than its supply, the price will typically increase and vice versa. Futures market prices depend on a continuous flow of information from around the world and require a high degree of transparency. A broad range of factors (climatic conditions, political situations, debt default, refugee displacement, land reclamation and environmental health, for example) impact supply and demand of assets (commodities in particular) - and thus the current and future prices of the underlying asset on which the derivative contract is based. This kind of information and the way people absorb it constantly changes the price of a commodity. This process is known as price discovery.

**2) Techniques of risk management:** Financial derivatives are useful for dealing with various types of risks, mainly market, credit and operational risks. The importance of derivatives has been increasing since the instrument has been used to hedge against price movements. The financial tool assists with the transfer of risks associated with a specific portfolio without requiring selling the portfolio itself. Essentially, derivatives allow investors to manage their risks and so reach the desired risk profile and allocation more efficiently. The relationship between derivatives and risk management is relatively simple. Derivatives are seen as the tool that enables banks and other financial institutions to break down risks into smaller elements. From this, the elements can be bought or sold to align with the risk management objectives. So, the original purpose of derivatives was to hedge and spread risks. The main motive of the financial tool has aided with the great development and expansion of derivatives.

**3) Operational advantages:** Derivative markets entail lower transaction costs. They have greater liquidity compared to spot markets. Derivative markets allow short selling of underlying securities more easily.

**4) Market efficiency:** Spot markets for securities probably would be efficient even if there were no derivative markets. A few profitable arbitrage opportunities exist, however, even in markets that are usually efficient. The presence of these opportunities means that the price of some assets is temporarily out of line. Investors can earn return s that exceed what the market deems fair for the given risk level. There are important linkages between spot and derivative prices .The ease and low cost of transacting in these markets facilitate the arbitrage trading and rapid price adjustments that quickly eradicate these profit opportunities .Society benefits because the prices

of underlying goods more accurately reflect the good's true economic values.

## 20.8 Shortcomings

Derivatives are associated with various shortcomings as well, some of which are very significant. Derivatives led to disastrous consequences during the 2007-2008 financial crisis because they led to a rapid devaluation of mortgage backed securities and credit default swaps which in turn was one of the key factors for the collapse of financial institutions and securities. Some of the significant disadvantages of derivatives are:

**High Risk :** Derivatives are a high-risk instrument. The volatile nature of derivatives can lead to huge losses. Moreover, the contracts are designed in such a way that it becomes very complicated for the investors to valuate them. Therefore, there is a very high inherent risk associated as well.

**Speculative features:** Derivatives are an instrument which are often used a speculation tool in the market. Derivatives are extremely risky and have an unpredictable behavior. Any unreasonable speculation using derivatives can thus wipe out a considerable portion of your capital.

**Counter Party Risk:** Derivative contracts are traded on the exchanges as well as over the counter. The contracts which are traded on the exchange go through a due diligence process,

however the over the counter contracts does not have any benchmark for due diligence. This leads to a risk of counter party risk.

**Conclusion**

Almost every other asset or instrument in the financial markets have both pros and cons and derivatives are no different. It requires lot of experience and knowledge to trade in derivatives effectively. If you want to use swing trading strategies to make the most out of derivatives, Delta Derivative Plus can help you. However, if you want to trade exclusively in equity derivatives, Equity Derivative Pack can prove out to be very useful for you. It is better to have your risk appetite calculated from an SEBI registered investment advisor before stepping into the lucrative world of derivatives.

**Test your understanding**

**Discuss the relevance of Derivatives**

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## 20.9 SUMMARY

- In the beginning futures and options were permitted only on S&P Nifty and BSE Sensex. Subsequently, sectoral indices were also permitted for derivatives trading subject to fulfilling the eligibility criteria. Derivative contracts may be permitted on an index of 80% of the index constituents are individually eligible for derivatives trading.

- The Standing Committee on Finance, a Parliamentary Committee, at the time of recommending amendment to Securities Contract (Regulation) Act, 1956 had recommended that the minimum contract size of derivative contracts traded in the Indian markets should be pegged not below Rs.2 Lakh.

- The term _Badla' denotes the system whereby the buyers or sellers of shares may be allowed to postpone the payment of money, or delivery of the shares, as the case may be, in return for paying or receiving a certain amount of money. It is also known as carry forward trading.

- In futures trading, the price for future delivery is defined in advance. In Badla, the price ultimately paid, inclusive of Badla charges, is indeterminate and becomes known only when the transaction is fully concluded. The Badla charges changes from time to time.

- Merits of derivatives are: price discovery of the underlying asset, technique of risk management, operational advantages, market efficiency.

## 20.10 SELF ASSESMENT QUESTIONS

1. What are the various types of Membership in the derivatives?

2. Explain the Rationale behind Derivatives.

3. Define the term Badla.

4. Differentiate between Badla and Futures.

5. Explain the relevance of financial derivatives in Indian Market.

6. Discuss the merits and shortcomings of derivatives.

## 20.11 Suggested Readings


1. Kolb,R.W. &Overdhal,J.A., Financial Derivatives, John Wiley & Sons, Inc.

2. Kumar, S.S.S., Financial Derivatives, PHI Learning Private Limited.

3. Parasuraman,N.R., Fundamentals of Financial Derivatives, Wiley India Pvt. Ltd.

4. Gupta, S.L., Financial Derivatives, PHI Private Limited.

## Rough Work