



Introduction to derivatives



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DISCLAIMER	



INTRODUCTION TO DERIVATIVES

1. INTRODUCTION

The purpose of this paper is to provide a short introduction on how derivatives products work. It is not meant to be a complete guide to the subject and we have simplified many of the structures so that it is easier to see what is at the heart of each instrument.

Derivatives are contracts between two or more parties that allow the parties to agree the *price of a transaction* that will take place in the *future*. The label “derivative” simply means that the value of the instrument is based on or derives from the value of an underlying instrument, asset or commodity that is to be bought or sold at some point in the future. Derivatives are used for both *hedging*, that is removing or reducing the price risk associated with an expected transaction at some future date, or for *trading* (speculation) and *arbitrage* purposes.

2. DEFINING DERIVATIVES

A *derivative* is a *financial contract*, or a contingent claim, whose *value depends* on the value of one or more underlying assets or indices of assets. Put another way, a derivative instrument is a financial contract, the price (value) of which has a *strong correlation* with an underlying commodity, currency, asset price of other financial instrument.

3. CLASSIFICATION

Basically, there are two different types of derivatives:

- Forward Contracts or Fixed-rate Derivative Instruments (Fixed rate/price)
- Options

Derivatives are also either traded in the *over-the-counter* (OTC) markets or are *exchange-traded*. Generally, when forward contracts are traded on a *recognized exchange*, they are known as *futures contracts*.

Forward contracts *fix* the price of a financial asset (such as the price of a bond, a share, a loan or a deposit) now, so that both parties are *obliged* to complete the deal at the *agreed rate* (price) on the *agreed future date*. A good example of this type of contract is a forward foreign exchange trade in which one side undertakes to buy, say, US dollars in return for rands for settlement three months in the future. Both parties have to deliver the respective currencies on the due date using the rate agreed at the time the deal was done, regardless of where the USD/ZAR exchange rate might have moved to since the transaction date.

Examples of forward-type derivative instruments are:

- **Foreign exchange:** Outright forwards (forward exchange contracts), currency futures and FX swaps
- **Debt (interest rates):** Forward rate agreements (short term), interest rate swaps (long term), currency swaps, short- and long-term (bond) futures
- **Commodity derivatives**
- **Equity derivatives:** Equity index futures, equity swaps
- **Credit derivatives**



An *option*, however, allows the holder (also known as the buyer) to decide whether or not to complete the transaction by exercising the option. Using the above example of a USD/ZAR deal, the option would have specified the rate (strike rate) at which the exchange of USD for ZAR would take place *if* the option holder wished to *exercise the option*. The option holder would, of course, only use the option if the prevailing market exchange rate at settlement were less favourable than that available through the exercise of the option.

Examples of options are:

- **Currency options**
- **Interest rate options:** Caps, floors, collars, swaptions and options on bond futures
- **Equity options:** shares, stock indices, warrants

These lists include examples of both over-the-counter (OTC) and exchange-traded derivatives. Both of these types of instruments achieve a *similar result* but use different trading methods, each with their associated advantages and disadvantages.

There are also many exotic variations on the instruments listed above, which are often produced by combining different derivatives to *generate a particular result*, which meet some *special requirements*. Such complex structures are, however, beyond the scope of this guide.

4. DERIVATIVES IN THE FOREIGN EXCHANGE MARKETS

Forward foreign exchange deals are a very long established type of derivative contract. Their use increased dramatically after 1971 when the major world currencies moved to floating exchange rates. The largest part of the world's foreign exchange market now deals for settlement for a value date later than spot (i.e. more than two business days ahead).

The simple mechanics of a forward foreign exchange deal have already been described above in the USD/ZAR example. The advantage of such an *outright forward*, as it is known, is that the parties have a *guaranteed rate* for their transaction (assuming that their counterparty does not default on the deal) and do not have to worry about any rise or fall in the value of the currency they are buying or selling. Of course, the disadvantage is that, by fixing the rate now, both sides have given up any *prospect of benefiting from favourable movements* in exchange rates.

The price at which a bank is prepared to *buy or sell* currency *forward* is determined by the way in which a bank can protect itself against market movements *before delivery*. The detail of this would take some time to explain but it depends on the interest rate differential between the two currencies. The differential between the interest rates can sometimes be a *cost to the bank*, in which case it will set the *forward rate below the spot rate*, or it can work in the bank's favour. In the latter case, competition in the FX market means that this benefit to the bank will have to be reflected in a *higher exchange rate forward*. In both cases, however, it is important to remember that the bank is only reflecting its hedging costs; it is not consciously attempting to penalise or benefit particular customers.

It is important to see that the forward exchange rate is not by itself a *forecast* of where the bank thinks the exchange rate will actually be by the time settlement happens. It is just derived from the *current spot exchange rate* and the *interest rates prevailing in the two currencies for the period of the forward contract*. A mathematical relationship exists between the spot FX market, money markets (interest rates) and the forward FX rate.



A foreign exchange swap is the *exchange of two currencies* for an agreed period of time, at the end of which the counterparties *re-exchange the currencies* with each other. It could be more simply described as a *loan in one currency against a deposit in another* for a given period of time. It is frequently used by banks to manage their *funding* when they have a surplus in one currency for a period and a funding need in another. For example, a bank might have a surplus of USD for a month (through receiving more deposits in USD than it can lend out) but be short of ZAR for the same period. By arranging an FX swap, the bank can therefore switch out of USD into ZAR in a single transaction for the period required, in order to fund the shortage of ZAR through the surplus of USD.

In a swap, the two counterparties will, however, need to take account of the relative interest rate of the two currencies involved. So, in our example of the bank swapping USD for ZAR, USD (in the current environment) earns a *lower interest rate* than ZAR, so the bank giving up the use of the USD will expect to pay the difference between the USD and ZAR interest rates. The difference in the two interest rates will be reflected in the number of ZAR that will be *re-exchanged* for the USD at the *end* of the swap. In effect, since the ZAR is a higher interest rate currency than the USD, the bank will repay more ZAR at the maturity of the swap.

5. FORWARD RATE AGREEMENTS

A FRA is a short-dated interest-rate derivative instrument designed to *synthesize* a forward-forward borrowing or loan. It is an *agreement* between two parties to exchange an interest differential (only) on a predetermined notional principal amount during a given time period, based on an *agreed future interest rate* basis during the given time period.

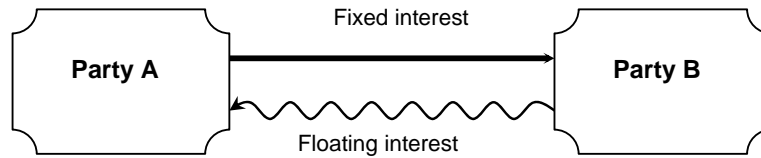
The interest rate differential is the difference between the *contract rate* (FRA rate) of the FRA and the *agreed upon market interest rate* (JIBAR/LIBOR) on which the settlement calculation is based.

The buyer of the FRA agrees to a *future borrowing* rate, i.e. is the counterparty to the FRA seeking protection against a *rise* in interest rate levels. The *seller* of the FRA will agree to a *future lending* rate, i.e. is the counterparty to the FRA seeking protection against a *fall* in interest rate levels. The notional principal amount is not borrowed or lent and no agreement is made to exchange the principal amount of the FRA transaction. Both parties to the transaction are only exposed to the *interest differential* between the agreed rate (contract rate) and the settlement rate (reference rate), where the latter is based on prevailing market rates on the settlement date. As the principal amount is never exchanged, exposure on the FRA is simply limited to the settlement payment.

6. INTEREST RATE AND CURRENCY SWAPS

Interest rate and currency swaps (as opposed to FX swaps) are the most recent form of financial instrument to emerge having first been used in their current form in 1981. Interest rate swaps are the most common form of the instrument, making up about 90% of the current estimated outstanding amounts of \$90 trillion, with currency swaps virtually all the remainder.

In its simplest form, an *interest rate swap* involves a legally enforceable agreement to *exchange regular interest payments* with a counterparty over a specified period of time. Typically, one party will make its interest payments on the basis of a *fixed rate* with the counterparty paying on a *floating rate* basis, usually set by LIBOR (JIBAR), both calculated on to the same notional principal amount.



Stated plainly like this, it is difficult to understand why anyone would want to use swaps. There are two principal attractions. Firstly, swaps allow borrowers to take advantage of relative borrowing costs and raise funds in the market where they can achieve the lowest funding costs.

If, for example, Company A can issue a *fixed rate bond* at less than the fixed rate received in the swap, it can use this flow of cash to pay the interest on its bond and still have something left over to subsidise its LIBOR payments in the swap. The *net result* (and with swaps it is always necessary to look at the *net position*) is that it is borrowing money (obtained from the bond issue) at below current LIBOR rates.

Secondly, the swap can be used to *modify* the *interest basis* of an existing loan or investment. For example, if B in the above diagram had an existing *floating rate loan* at a margin above LIBOR, receiving LIBOR in the swap would offset the floating part of its interest payments on the loan, leaving it paying the fixed rate (on the swap) and its loan margin. The *net result* would be that it had converted its *floating rate loan* into a *fixed*.

Currency swaps work in a similar fashion except that there are *two currencies* used for the interest payments and there is also an exchange of the principal amounts in the two currencies at the *start and the end of the swap*.

A *currency swap* is a contract between two parties to exchange payments in *one currency for payments in another*. In its simplest form, the currency swap involves the exchange of fixed interest payments in one currency for fixed interest payments in another currency. This is called a *fixed-for-fixed* currency swap.

A standard cross-currency swap is similar to a normal interest rate swap, except:

- That the currencies of the two legs of the swap are different
- The principal amount is exchanged at maturity (the exchange of principal at inception is optional)
- The legs of the currency swap (in two different currencies) may be:
 - Both fixed-rate payments;
 - Both floating rates;
 - One fixed-rate and one floating.

Equity swaps involve a flow of payments linked to a stock market index with a series of interest payments, usually set by reference to LIBOR.

7. FUTURES MARKETS

The financial futures markets developed out of the well-established commodity markets trading agricultural produce in the USA. The first of these financial markets emerged in 1972 with currency futures being traded at a subsidiary of the Chicago Mercantile Exchange (CME). Since then, we have seen other similar exchanges open around the world with prominent markets now in London (LIFFE), Paris (the MATIF) and Germany (DTB).



Futures markets are simply about *buying and selling* financial instruments or currencies at a future date by locking/fixing the price/rate today. What sets them apart from forward deals arranged with banks is that trading takes place on a formal exchange and is *subject to standardised terms and conditions*. These specifications are designed to improve liquidity as everyone is dealing with the same commodity, but this does reduce flexibility on using futures for hedging. The futures are also only dealt for a limited number of delivery dates, usually four specified dates each year. Again, this is to encourage trading, but reduces flexibility in matching the underlying exposures to the outcomes of the futures contracts. Financial futures exchanges provide an *active and organised marketplace* where members trade in *standardised contracts* under *established regulations*.

The basic functions of a futures exchange are to provide:

- The necessary facilities to trade the futures contracts
- The framework for arbitration in the event of disputes
- Information relevant to the market
- Appropriate rules to facilitate trading

All transactions made during a trading day on the futures exchange must be reported to the clearing house.

The role and functions of the clearing house are:

- To guarantee the fulfilment of all the contracts traded on the exchange
- To hold all the deposits and margin requirements
- To act as the contractual counterparty to each member's transaction
- To handle the cash settlements of all cash-settled futures contracts
- To record all business of the exchange
- To oversee the delivery of all physical deliverable futures contracts

A futures contract is an *agreement to buy from or sell to a futures clearing house, a standard quantity and quality* of a specific asset, commodity, notional asset, on a *specific date in the future, at a price* which is *determined* at the time the contract is entered into.

Financial futures contracts can be divided into three main groups:

- **Currency futures**

A currency future is an agreement to buy or sell a standard quantity of a specified currency against another currency, on an organised exchange, at a price/rate agreed between the relevant parties and with delivery to be executed on a standard future date. Example, futures on USD, JPY, EUR, CHF, and ZAR.

- **Interest rate futures**

An interest rate future is an agreement to buy or sell a standard quantity of a specified interest rate instrument, on an organised exchange, at a rate agreed between the relevant parties and with delivery to be executed on a standard future date. These are divided into short-term and long-term interest rate futures. Example: Treasury-bill futures, Treasury-bond futures, JIBAR futures contract, and bond futures (R150, R153).



- **Stock index futures**

A stock index future is an agreement to buy or sell a standard quantity of a specified stock index, on an organised exchange, at a price/rate agreed between the relevant parties and with delivery to be executed on a standard future date. Example, futures on Dow Jones, S&P 500, Nikkei 225, FT-SE 100, DAX, CAC40, ALSI, GLDI, INDI and FNDI.

Listed below are some major financial exchanges around the world:

DTB	Deutsche Terminbörse
CBT	Chicago Board of Trade
CME	Chicago Mercantile Exchange
IMM	International Monetary Market (part of CME)
LIFFE	London International Financial Futures Exchange
MATIF	Paris Futures Exchange
ME	Montreal Exchange
NYFE	New York Futures Exchange (part of NYSE)
NYMEX	New York Mercantile Exchange
NYSE	New York Stock Exchange
PSE	Philadelphia Stock Exchange
SFE	Sydney Futures Exchange
SAFEX	South African Futures Exchange

To trade on the floor of an exchange, a company or individual must be a member. Becoming a member entails *buying or renting a seat* on that exchange. This can be an expensive business. A seat on one of the top exchanges such as the IMM can cost upwards of US\$500,000. For a company or individual wishing to trade futures, it is not necessary to become a member. It is simply a matter of establishing a *futures account* with one of the exchange members who, for a small fee (brokerage fee), will execute transactions with the floor on their behalf.

Once a transaction has occurred on the floor of the exchange between two exchange members, the transaction is processed and, barring any problem matching the buyer with the seller, the clearing house assumes all further responsibility for the transaction. In other words, the *clearing house* becomes the *counterparty* to both the *buyer* and the *seller*.

When arranging the purchase or sale of futures contracts, it is only necessary to pay a small percentage of the value of the trade, known as the *initial margin*, at the time that the deal is struck. This can be both good and bad news. Having bought or sold futures contracts, the value of that position will change by the full amount of the contract value, but having only paid the margin, the effect of any change in the price of the futures will be magnified when compared with our margin.

The margin payment has another purpose. It is paid to the clearing house, which manages the settlement of futures business. Its level is set to *cover day-to-day movements* in the value of a futures position. The clearing house acts as the counterparty for each futures trade and the value of the margin account protects it in the event of default by the traders on the exchange. As this arrangement effectively removes *counterparty risk* in futures transactions, everyone is able to deal at the *same price*.



8. OPTIONS

As described at the start of this paper, an option is an arrangement, which gives the holder the right, but not the obligation, to buy or sell a financial instrument at a fixed price, at an agreed date in the future.

The option holder can therefore choose the *better price* from either the *prevailing market* price or the *price specified in the option*. This is in contrast to forward deals with a bank or through a financial futures exchange, which have to be settled if not reversed before maturity. An option can be regarded as a form of insurance — if the market moves against you, you are protected, but you can still take advantage of better prices if the market moves in your favour.

Of course, something this good does not come for free! The catch is that when options are bought, the premium has to be paid at the time of purchase, i.e. *upfront*. The actual amount of the premium depends on a number of factors, which take into account how likely it is that the option will be exercised.

The option contract has a unique characteristic that distinguishes it from any other financial instrument: *the buyer (holder) of an option has the right, but not the obligation, to buy or sell a specified financial asset at a pre-specified price, on or before a specific date in the future.*

An option holder, therefore, only exercises the option, i.e. takes up the rights of the option, when is profitable to do so. The *maximum financial loss* that the *buyer* of the option can incur is the *premium* (cost) of the option.

The *strike price* or *exercise price* (rate) is the price (rate) at which the buyer of the option is entitled to either buy or sell the underlying financial instrument. The *expiry* or *expiration date* of the option is the final date at which the option may be exercised in terms of the option contract.

A *European option* may be exercised on the expiration date of the option only, while the *American option* may be exercised at any time up to and including the expiration date.

Two types may be bought or sold:

- The *holder (buyer) of a call option* has the right to buy the financial asset, while the *seller of the call option* has to *sell* the financial asset if and when the holder thereof takes up the right.
- The *put option* gives the holder (buyer) *the right to sell* the underlying financial asset to the seller of the option who *buys* the asset if and when the option is exercised.

The *premium* of the option is the *cost incurred* by the buyer thereof to obtain the right to buy (call) or sell (put) the underlying financial instrument. It represents compensation to the seller for the risk involved with the option contract over the option period. The premium is normally paid upfront.

Option markets can be categorized into two basic types. An option market is either an:

- **Over-the-counter (OTC) market** — There is no formal market and the option contracts traded have specifications which are mutually satisfactory to both the buyer and the seller
- **Exchange-traded option market** — Highly standardised option contracts are traded at a specific market place. Options traded on these formal exchanges are backed in terms of performance of counterparties by the exchange clearing house.



Options can be used for *trading* as well as *hedging* and they are leveraged in the same way as futures, because the premium paid upfront is a percentage of the value of the underlying instrument or currency.

Terminology used in options:

Call option: An option that gives the holder the right to buy the underlying instruments at a specified price on or before a specific date in the future.

Put option: An option that grants the holder the right to sell the underlying security at a certain price on or before a specific date in the future.

American option: This option may be exercised at any time, up to and including the expiration date.

European option: The European option may be exercised on the expiration date only.

At-the-money (ATM): The market price of the underlying security and the strike price of the option are equal.

Exercise: To exercise the option means to invoke the right granted in terms of the option. The holder/buyer is the party exercising the option.

Exercise/strike price: The price at which the option holder may buy (call) or sell (put) the underlying instrument.

Holder/Buyer: Is the owner of the option contract.

In-the-money (ITM): A term that describes an option that has intrinsic value. A call option is ITM when the market price trades higher than the strike price of the option. A put option is in-the-money when the market price trades below the strike price of the option.

Intrinsic value (IV): The value of an option if it was to be exercised immediately, i.e. the amount by which an option is in-the-money. For a call: $IV = \text{market price} - \text{strike price}$ and for a put: $IV = \text{strike price} - \text{market price}$.

Out-the-money (OTM): Describes an option that has no intrinsic value. A call option is out-the-money when the market price is below the strike price, while a put option is out-the-money when the market price is above the strike price of the option.

Premium: The price of an option, i.e. the total cost of the option. The premium represents the sum of the intrinsic value and time value of the option.

Time value: The portion of the option premium in excess of the intrinsic value.

Volatility: A measure of the amount by which the underlying asset is expected to fluctuate in price in a given period of time.

Writer: Seller of the option.

9. SUMMARY

- Derivatives contracts are financial instruments which derive their value from the underlying cash/spot markets.
- Derivatives instruments allow for the fixing of a price/rate today, but for delivery or settlement at a specified future date.
- Derivatives contracts may be used to hedge undesirable exposures to changes in FX rates, interest rates, commodity prices and equity prices over time. These instruments may also be used to create exposures to changes in financial asset prices in order to profit from expected price changes. Finally, the contracts may also be used to profit from temporary price differences between different, but related or interlinked markets (arbitrage).
- Derivatives are either fixed rate/price contracts (forwards/futures/FRAs/swaps) or option-type instruments (calls/puts/caps/floors) which set a maximum/minimum price or rate (options).
- Derivatives can be traded in OTC markets or on organised financial exchanges.



- Forwards have linear pay-off profiles while options have non-linear payoff profiles. On an option transaction, the buyers' maximum loss potential is limited to the premium paid.