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ACI Australia Dealing Simulation

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20th – 23rd August 2014

The *FASTEST* Way to Learn the Dynamics of the FX Market

&

The only hands-on SIMULATED Dealing Course of its kind in the world!

Please take a minute to read the important information below:

- Casual dress throughout the course is appropriate.
- All delegates must wear the lanyard displaying their name and that of their course bank at ALL times
- A copy of the program for the 3.5 day course will be available on arrival. Please be punctual to all sessions. Late arrival will incur fines, which will be deducted from your team's trading P & L.

  Any changes will be advised by the course facilitators
- Penalties to your team's P & L are at the discretion of the course facilitators and no correspondence will be entered into

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WHAT IS FOREIGN EXCHANGE?

The term foreign exchange means the exchange of one currency for that of another. Millions of foreign exchange transactions take place throughout the world each day for different reasons. The FX market is by far the largest financial market in the world with the major centres in London, New York, Tokyo.

Foreign exchange transactions arise from international trade, capital flows, investment and speculation with various participants.

INTERNATIONAL TRADE

This is the most obvious of all of the reasons for foreign exchange transactions. Looking around us we see a number of products which have been produced or manufactured in a foreign country. The recent increase with China, Korean and Taiwanese produced goods is clearly evident around us today. Companies in the US import these products from the manufacturing country. Typically a manufacturing company in Korea would sometimes requests payment in Korean won or any convertible currency whereupon the US company would have to purchase the required currency. A large portion of the world's trade is settled in US dollars.

So, how does it work?

Let's take the example of a Korean company which manufactures tennis racquets in Korea and sells them to a company in USA. The cost to the Korean manufacturer to produce and ship the goods, say 1000 racquets, to USA is KRW 40,000,000. As the KRW is not a commonly convertible currency, the Korean company invoices all their exports in Euro. Cost to US importer = KRW 40 mio / 1440 (EUR/KRW rate) = EUR 27,777.78

The goods arrive in USA and the US importer approaches his bank and requests they pay the Korean company EUR 27,777.78 and debit his account for the US dollar equivalent. The bank sells Euro at 1.3360, therefore, the cost to the US importer is US$37,111.11 (Euro 27,777.78 x 1.3360) Once the Euro funds arrive in Korea they are exchanged by the Korean manufacturer's bank for won and the trade transaction is completed.

CAPITAL TRANSACTIONS

This item includes such things as:

- Investments by a company or individual in an asset denominated in another currency,
- Borrowing of funds by a government, company or individual in a foreign currency.

For example, let's say a large British corporation wish to establish a subsidiary in the US. For the US Company to be successful it requires working capital of, US$10 million to purchase plant and equipment and to maintain a liquid position until it can produce a reasonable return. There are two ways that the company can raise the necessary capital:

i) By borrowing, US in US market, or

ii) By utilising funds available to it in the UK.

If the company decides to utilise its UK funds it will need to convert these funds into US dollars. This can be done either in Great Britain or US, as both currencies are readily convertible in either centre. Of course, there are other methods of raising capital than those mentioned above.

INTERMEDIATION

Banks act as intermediaries between customers that buy and sell foreign currencies. Frequently, a bank that buys foreign currency from a customer will trade with another bank to lay off its risk by selling the currency.

SPECULATION

Foreign exchange speculation refers to buying a currency against another currency, with a view to reversing the deal and gain a profit. Positions can be taken for very short periods or long periods, although long term positions in speculative markets are normally closed prior to maturity.

Speculative positions may also be taken against interest rate movements. These can be done either via the forward market or Interest rate market. There are many and varied forms of speculation involving foreign exchange and interest rates, whether they are against each other or other commodities, they are limited only by your perceived risk/return expectations and credit.

WHO MAKES UP THE FOREIGN EXCHANGE MARKET?

The foreign exchange market consists of central banks, commercial banks, investment banks, funds & insurance companies, corporations and wealthy individuals all acting as principals in the market. There are also intermediaries in the market such as brokers. Each of the market participants has an important role within the market.

BIS Triennial Central Bank Survey

In April 2013, 53 central banks and other authorities participated in the Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity. They collected data from about 1,300 banks and other dealers in their jurisdictions and reported national aggregates to the BIS, which then calculated global aggregates. This was the ninth global survey since April 1989 of foreign exchange market activity and the seventh survey since April 1995 additionally covering OTC derivatives market activity.

Trading in foreign exchange markets averaged $5.3 trillion per day in April 2013. This is up from $4.0 trillion in April 2010 and $3.3 trillion in April 2007. FX swaps were the most actively traded instruments in April 2013, at $2.2 trillion per day, followed by spot trading at $2.0 trillion.

The growth of foreign exchange trading was driven by financial institutions other than reporting dealers. The 2013 survey collected a finer sectoral breakdown of these other institutions for the first time. Smaller banks (not participating in the survey as reporting dealers) accounted for 24% of turnover, institutional investors such as pension funds and insurance companies 11%, and hedge funds and proprietary trading firms another 11%. Trading with non-financial customers, mainly corporations, contracted between the 2010 and 2013 surveys, reducing their share of global turnover to only 9%.

The US dollar remained the dominant vehicle currency; it was on one side of 87% of all trades in April 2013. The Euro was the second most traded currency, but its share fell to 33% in April 2013 from 39% in April 2010. The turnover of the Japanese yen increased significantly between the 2010 and 2013 surveys. So too did that of several emerging market currencies, and the Mexican peso and Chinese renminbi entered the list of the top 10 most traded currencies. Methodological changes in the 2013 survey ensured more complete coverage of activity in emerging market currencies.

Trading is increasingly concentrated in the largest financial centres. In April 2013, sales desks in the United Kingdom, the United States, Singapore and Japan intermediated 71% of foreign exchange trading, whereas in April 2010 their combined share was 66%.

With growth in global FX turnover of about 35% at current exchange rates, the 2013 survey results continue the trend of strong turnover growth evidenced in past Triennial Surveys. FX turnover computed at constant exchange rates grew roughly by the same magnitude. The growth in global FX market activity between 2010 and 2013 outpaced the 19% rise from 2007 to 2010 reported in the prior survey, but falls short of the record 72% increase (at current exchange rates) between 2004 and 2007.

The role of the US dollar as the world's dominant vehicle currency remains unchallenged. FX deals with the US dollar on one side of the transaction represented 87% of all deals initiated in April 2013, about 2 percentage points higher than three years ago. The euro remains the second most important currency worldwide, but its global market share decreased by almost 6 percentage points to 33%, reaching the lowest value since the introduction of the common currency. Trading in the most actively traded euro exchange rate crosses, such as EUR/JPY, EUR/GBP and EUR/CHF expanded less than that in their USD counterparts.

Among the most actively traded advanced economy currencies, the Australian and New Zealand dollars continued increasing their share in global FX trading. By contrast, Sterling, the Canadian dollar, the Swedish krona and, most notably, the Swiss franc lost ground in global FX trading in relative terms. The 2013 Triennial Survey further shows a significant rise in the global importance of several major emerging market currencies. Turnover in the Mexican peso reached $135 billion in 2013, raising the peso's share in global FX trading to 2.5%. The Mexican peso has thus become part of the group of the world's 10 most actively traded currencies, ahead of well-established currencies such as NZD and SEK. The Russian rouble also saw a significant increase in market share, making it the 12th most actively traded currency worldwide.

The role of the renminbi in global FX trading surged, in line with increased efforts to internationalise the Chinese currency. Renminbi turnover soared from $34 billion to $120 billion. The renminbi has thus become the ninth most actively traded currency in 2013, with a share of 2.2% in global FX volumes, mostly driven by a significant expansion of offshore renminbi trading.

Spot market trading grew by 38% to $2 trillion per day in April 2013, contributing about 40% to the rise in global FX market activity between 2010 and 2013. While again a significant driver of the rise in global FX turnover, growth in this market segment was more moderate compared to its 48% increase between 2007 and 2010.FX swaps remained the most actively traded FX instrument in 2013, but at 27%, the growth in trading did not keep pace with that of the overall market. Their daily volume of $2.2 trillion accounted for 42% of all FX-related transactions, 2

percentage points less than in 2010.Turnover of currency swaps also grew at a similar rate (26%); with a turnover of $54 billion per day, this instrument continued to account for a small share of the overall market.

Trading activity increased more strongly in other parts of the FX OTC derivatives market, in particular forwards and FX options. Trading volumes of outright forwards trended up to $680 billion in 2013 from $475 billion in 2010, a 43% increase. The share of forwards in overall FX trading edged up slightly, by 1 percentage point to 13%, the highest since the survey began. Trading of FX options increased the most, by more than 60%. Taken together, the rise in turnover of FX forwards and options accounted for almost a quarter of global FX turnover growth between 2010 and 2013.

WHAT FACTORS INFLUENCE EXCHANGE RATES?

Economic factors can move a market in both the short term and long term. For instance, it is well known what reaction can be generated in the US market when the current account or CPI figures are released. While the figure for any given month or quarter can be good or bad, it is the overall figure that finally determines the state of the economy. However, as the monthly or quarterly figures are released the currency is, more often than not, subject to large movements. These movements may not always be logical, for instance say the BOP figure released in June showed a current account deficit for the first quarter of 5.9% of GDP up from 5.1% a year earlier. Most observers would consider this a negative factor for the US. However, the market reaction was to buy the currency. This was mainly due to the fact that the market had been conditioned by market analysts to expect a higher number so the figure had already been "built into" the exchange rate.

Political factors can also have a dramatic influence on exchange markets. Who can ever forget the decision by the G5 (Group of Five Nations) in September 1985 to collectively intervene in the market to stop the US dollar appreciation. Prior to that decision the adage "Buy dollars – wear diamonds" could not have been truer. However, a frantic rush to liquidate long dollar positions caused major falls in the US dollars value and wide spreads were quoted by those market makers still left in the market. Continued intervention over the following months turned the market from bullish for the dollar to completely bearish. This old example combines political and central bank intervention, however, political problems and statements also cause market reaction on their own.

Speculative trades can dramatically move the market. The 1998 "Asian crisis" was generally attributed to large scale selling of Asian currencies by Hedge Funds. However, the impact of speculative trading depends on the supply and demand factor. For instance, speculation against a certain currency may meet resistance from a corporate transaction and if the size of the corporate transaction provides sufficient supply to counteract the speculative factors, for even a short period, it may be enough to reverse the trend completely as the speculators liquidate their positions. This reversal can have a domino effect as traders scramble to take profit or limit loss. Although, if the rate moves too far it may be perceived by the speculators as a better level at which to re-establish their positions, and thus the currency will find a "level" and the trading range will narrow.

If an exchange rate moves too quickly or too far in one direction it may be the subject of Central Bank intervention. Exchange rates affect such things as the cost of imports, the competitiveness of exports and the cost of maintaining and servicing foreign debt. Therefore, it is at times in the Government's best interest to maintain certain levels of stability within the marketplace. Intervention can be direct, by selling or buying the currency directly in the market, or by altering fiscal policy, thus changing the market perception of the currencies value. The latter move is designed to alter the currency's trend, however, if the Central Bank wishes to smooth market conditions, its level of intervention will be less intense and may be done anonymously via a bank or broker. Like all transactions, deals done on behalf of a Central Bank by banks or brokers are done under the strictest confidence. However, sometimes Central Banks choose to increase the impact of intervention by "jawboning". Central Bank intervention is most effective when done on a concerted basis. The combination of jawboning and concerted Central Bank intervention is almost invariably successful. For example, if the G7 announces that they consider dollar/yen too high at 105 and the Fed, the Bank of England, the European Central Bank, Bank of Japan and other Central Banks are all seen selling dollars, the market would quickly realise that the best opportunity to make money is to be short dollars around 105 yen.

HOW THE FOREIGN EXCHANGE MARKET WORKS

The foreign exchange market is like many other markets. There are sellers and buyers, brokers and market jargon, the only significant difference is the commodity, which is money. The way in which this commodity is sold, bought, borrowed or lent is categorised into exchange rate or interest rate related items.

If we reflect back to the barter system, we will be able to grasp the basics of the foreign exchange market. The cowrie shell was once used as a measure of the value of other items and has today been replaced by a common denominator, money. All goods and services are now values in terms of money, so, how do we value one country's currency against that of our own or that of a third country?

In order to price an exchange rate we need to specify a base currency and a value date. In most cases the base currency is either the USD or the Euro. However, there are some exceptions to this e.g. AUD, NZD and GBP. Because of time zone constraints exchange rates are generally quoted for spot value. Although electronic processing now allows transfer of funds almost instantaneously, spot (two day value) remains the accepted convention by which currencies are most commonly priced.

So, let us examine the price and the effect value dates have on currencies; starting with spot rates.

SPOT EXCHANGE DATES

A spot foreign exchange deal is defined as “A MARKET WHERE THE TRADES DELIVER AND SETTLE NORMALLY TWO GOOD BUSINESS DAYS AFTER THE CONTRACT DAY”.

For instance, a deal done on a Tuesday will settle the following Thursday, whilst a deal done on a Thursday will settle the following Monday, under normal circumstances. A business day is defined as one in which normal trading is carried our in both settlement countries. If a deal is done against USD (base currency) and the next day is a holiday in the United States, then that day is not counted as a settlement day for the purpose of defining spot value. In such cases it is possible to have the same spot value for two consecutive days.

Settlement of both sides of a foreign exchange deal must be made on the same day otherwise one party will be liable for overdraft interest payments. Because of time zone differences, settlement will take place on any given working day earlier in Asia, later in Europe and lastly in the USA or Canada. This creates a delivery risk which we will expand upon later.

BASE CURRENCY / VARIABLE OR TERM CURRENCY

A foreign exchange quotation involves two currencies, the base currency on the left hand side of the quoted pair and the variable or term currency on the right hand side. Thus, if USD 1.00= JPY 98.10, USD if the base currency and JPY is the variable or term currency. Exchange rates should be expressed as base currency/variable currency. E.g. USD/JPY 98.10

Historically, the USA has been the world trade leader and most international trade has been transacted in US dollars (even transactions involving countries other than USA). For example, if an Australian mining company sells coal to a Japanese company, the coal would be prices in USD. As a result, most currencies are traded in the interbank market against the US dollar (USD). However, with the emergence of the Euro an increasing number of exchange rates are being quoted against the EUR.

PRICE MAKER / PRICE TAKER

In any transaction there are two parties – a price maker and a price taker. In foreign exchange transactions each party buys one currency and sells the other currency.

Example Exchange of EUR for USD

	Party A			*Party B*	
Buys	EUR	⇆		Sells	EUR
Sells	USD	⇆		Buys	USD

The two parties perform different roles. One acts as a price maker whilst the other is the price taker.

In the foreign exchange market the price maker will quote its rate to buy and/or sell and the price taker (who is usually initiating the contact) will decide if it will transact on the quoted price or not. In a bank to customer transaction the bank is the price maker and the customer is the price taker.

In a bank to bank transaction, the bank initiating contact is the price taker and the bank being contacted (which quotes the price) is the price maker.

SPOT SELLING AND BUYING RATES

A bank will normally quote a "two way" price at which it is willing to sell or buy the variable currency against the base currency. So a bank may quote a spot rate of USD 1.00 = JPY 98.10 / 98.13. In the normal course of business the rate would be quoted 10 / 13 which indicates that the price maker is willing to buy USD (sell JPY) at 98.10 and sell USD (buy JPY) at 98.13. The maxim is buy low, sell high.

SPOT FOREIGN EXCHANGE CROSS RATES

A cross-rate is an exchange rate which is derived from two other exchange rates. Normally, this means that neither of the currencies quoted is USD.

Examples	GBP/CHF	-	GBP	(Base)	/	CHF	(Variable)
	AUD/JPY	-	AUD	(Base)	/	JPY	(Variable)

The same principles apply to a cross-rate as to rates against the USD. The first named currency is the base currency and the second named currency is the variable currency. Normally the stronger of the two currencies will be the Base currency.

In a two-way price for AUD/JPY (the AUD is the base currency) the price maker will BUY AUD (sell JPY) on the left hand side of the price and SELL AUD (buy JPY) on the right hand side of the price.

Cross-rates are derived from quotes against the USD.

Three basic rules to follow in calculating cross-rates are:

1. Crossing a currency with the USD as the base rate and a currency with the USD as the variable rate you will always multiply one by the other, using the same side of the two-way price spread.

   Example AUD/JPY AUD/USD 0.9410/13 - USD/JPY 98.10 / 13

   Bid = 0.9410 x 98.10 = 92.31 and
   Offer = 0.9413 x 98.13 = 92.37

   The two way cross-rate = 92.31 / 37

Remember the bid rate must always be less than the offer rate. So, to calculate the bid cross rate you need to multiply the two smaller numbers (the bid rates) and to calculate the offer cross rate you need to multiply the two larger numbers (the offer rates).

2. Crossing two currencies with the USD as the base rate, you divide the cross-rate base currency from one side of the spread into the variable currency from the other side of the spread.

   Example SGD/JPY USD/SGD 1.2470 / 75 - USD/JPY 98.10 / 13

   Bid = 98.10 / 1.2475 = 78.64 and
   Offer = 98.13 / 1.2470 = 78.69

   Price for SGD/JPY = 78.64 / 69

Remember the bid rate must always be less than the offer rate. So, the bid cross rate will be the smaller number (bid) divided by the larger number (offer) and the offer cross rate will be the larger number (offer) divided by the smaller number (bid). If when you calculate bid/offer cross rates your bid rate turns out to be higher than your offer rate you have made a mistake so start again.

Crossing two currencies with the USD as the variable rate, you divide the cross-rate quoted currency from one side of the spread into the base currency from the other side of the spread.

Example AUD/NZD AUD/USD 94.10 / 13 - NZD/USD 0.8386 / 89

Bid = 0.9410 / 0.8389 = 1.1217 and
Offer = 0.9413 / 0.8386 = 1.1225

Price for AUD/NZD = 1.1217 / 25

Again, remember that the bid rate must be less than the offer and it will be obvious which rate you need to divide into which other rate.

CURRENCY FUTURES

WHAT IS A CURRENCY FUTURE?

A ‘currency future’ is an agreement to buy or sell a standard quantity of a specified currency, at a specified price, on a specified future date.

Futures contracts are a type of forward contract, meaning they represent a pledge to make a certain transaction at a future date. Futures are distinguished from over-the-counter (OTC) forward contracts in that they:

- contain standardised terms
- trade on a formal exchange
- are regulated by overseeing agencies
- are guaranteed by clearing houses

They are firm agreements to deliver (or take delivery of) a standardised amount of something on a certain date at a predetermined price. Futures contracts exist in currencies, money market deposits, bonds, shares and commodities.

FURTHER TERMINOLOGY

Currency futures are traded in standardised, transferable parcels called contracts. They are governed by their contract specification, which details the size of each contract, when delivery is to take place and what exactly is to be delivered.

The contract unit or size specifies the amount of underlying currency to be delivered per contract. This is also known as the 'face value' of the contract.

The 'futures price' is the rate at which the two counterparties in a futures contract agree to transact at on the settlement date. In a currency future, this is usually the calculated arithmetic mean of a range of price quotations on the last trading day prior to settlement the date. Prices are quoted in USD per currency.

The 'last trading day' is usually the second business day immediately preceding the third Wednesday of the contract month (usually Monday); however it depends on the futures contract, as some may vary.
The 'settlement date' is the date of completion and execution of the terms of the contract, delivery takes place on the third Wednesday of the contract month. That is, the date by which a buyer must pay for the securities delivered by the seller — in this case the delivery of the underlying currency.

The 'delivery month' is the month during which a futures contract expires, and during which delivery takes place according to the terms of the contract. It is also known as the month in which a contract expires and delivery of the underlying asset or cash is required for contract fulfilment. For currency futures, this is usually March, June, September and December.

A 'tick' is the smallest permitted price movement in a future contract. As each futures contract is a standardised size, the smallest price movement is known as the 'tick value'. Therefore the tick value represents the minimum upward or downward movement in the price of the future security.

A currency futures contract can be 'closed' out by making an offsetting trade, or taking delivery of the underlying currency at maturity.

There are two parties to a currency futures contract: a buyer and a seller. The buyer of a futures contract enters into an obligation to buy the foreign currency on a specified future date. The seller of a futures contract is under an obligation to sell the foreign currency on a specified future date.

The risk to the holder of a currency future is unlimited, and because the payoff pattern is symmetrical, the risk to the seller is unlimited as well. Loss and gains by each party on a futures contract are equal and opposite. In other words, futures' trading is a 'zero-sum game'.

The clearing house acts as an intermediary in futures transactions, as it guarantees the performance of each party to the transaction. It is also referred to as a firm that guarantees the obligations of the parties in an exchange-traded security, in this case currency. It protects investors from default risks between other investors or firms. In order to ensure that payment occurs, futures have a 'margin requirement' or 'clearing margin'. This margin is calculated as the difference between the current value of the futures position (mark-to-market) and the position value at the time of purchase/sale. This margin is calculated and settled daily with the clearing house — in the form of payment/receipt into each party's margin account.

CME Group was founded in 1898 and is the largest and most diverse financial exchange in the world for trading futures and options. They created the first ever financial futures contracts in 1972 with the introduction of FX futures. CME clearing matches and settles all trades and guarantees the creditworthiness of every transaction that takes place in their markets.

CME Group FX offers a full global product suite of 49 futures and 32 options contracts on 20 currencies traded against the U.S dollar, including major currencies such as the Euro and Japanese yen, as well as the currencies of countries with emerging markets, such as Korea and China.

For example, a trader who buys a December 2013 Australian dollar futures contract at a price of AUD/USD 0.9390 is effectively making an agreement to buy Australian dollars and sell USD dollars at a price of USD 0.9390 in December 2013. The currency future contract price essentially represents a forward foreign exchange price.

QUOTATION OF CURRENCY FUTURES

Currency futures contracts have their face value in the non-US dollar currency. The price, however, is typically expressed as US dollar per currency.

WHEN TO USE CURRENCY FUTURES
Currency futures can be used for speculative, hedging and arbitrage purposes. A transaction in which a future is purchased to open a position is known as a long position — 'going long of the future' or 'long'. A transaction in which a future is sold to open a position is known as a short position — 'going short of the future' or 'short'.

DEBT MARKETS
In the generic sense, debt is borrowing in order to facilitate the purchase of assets. Debt enables the borrower to use additional funds to increase their financial leverage. The most common form of debt is that issued by governments, banks and corporations. Other forms include asset-backed debt or securities that are issued by special purpose companies to fund asset purchases. As we have already discussed, debt securities are tradeable securities, that is, lenders/investors can buy and sell the debt securities depending on their outlook for the performance of the instruments, and/or their investment needs. The characteristics of debt products vary according to the type of instrument. The main characteristics are:

- the maturity of the instrument, i.e. how long the money is lent for
- the period for which the interest rate is fixed. This may be the same as the maturity (fixed rate) or the rate may be reset during the life of the instrument (variable or floating rate)
- for variable rate instruments, the reference rate (such as a bank bill or treasury rate) is used to set the base interest, to which is added a margin to reflect the credit or liquidity risk of the instrument
- number and nature of cash flows occurring over the life of the instrument, for example, whether the instrument pays interest periodically during its life or as a bullet payment at the end
- the way ownership is recognised and can be transferred. Ownership of negotiable instruments is by 'physical' holding, while ownership of registered securities is recorded in a register maintained either by the issuer or by a registry service provider
- where the instrument ranks in the issuer's capital structure with respect to the prioritisation of repayment of cash flows and principal. Secured debt has a preferred priority over the value of a specified security, whereas unsecured debt ranks below (i.e. junior to) secured, but above (i.e. senior to subordinated debt and equity.
- the rating or perception of the level of credit risk of the issuer if no credit enhancement is provided. A rating is a relative default ranking to enable investors to compare one security to another.
- the level of credit risk of the issuer if no credit enhancement is provided

Debt market is divided into two distinct market segments, short-term and long-term. The various types of short-term and long-term debt products are discussed in the following sections.

SHORT-TERM DEBT PRODUCTS
Also known as money market securities, short-term debt products involve debt with an original term to maturity of less than one year. Turnover of short-term debt instruments is high because the debt products have frequent maturities, enabling and necessitating traders and investors to continually assess new opportunities.

Securitised short-term debt products are generally negotiable, i.e. ownership is transferred through physical holding. They generally pay no interest until maturity, when principal and all interest is paid, and as such is issued as discount instruments with the discount being based on the yield to maturity. That is, the payment at maturity is fixed as the face value, with the price varying depending upon the market interest rate and the remaining term to maturity. Short-term instruments are considered to be financing instruments i.e. their specific purpose is to cover short-term funding shortfalls.

CASH TRANSACTIONS
Cash transactions are traditional loans and deposits with a very short-term to maturity. There is little, if any, requirement for the products to be negotiable, so they are not securitised. The main cash transaction types are:

- overnight call (11 am cash)
- 24-hour call money ('7 day')
- term loans and deposits

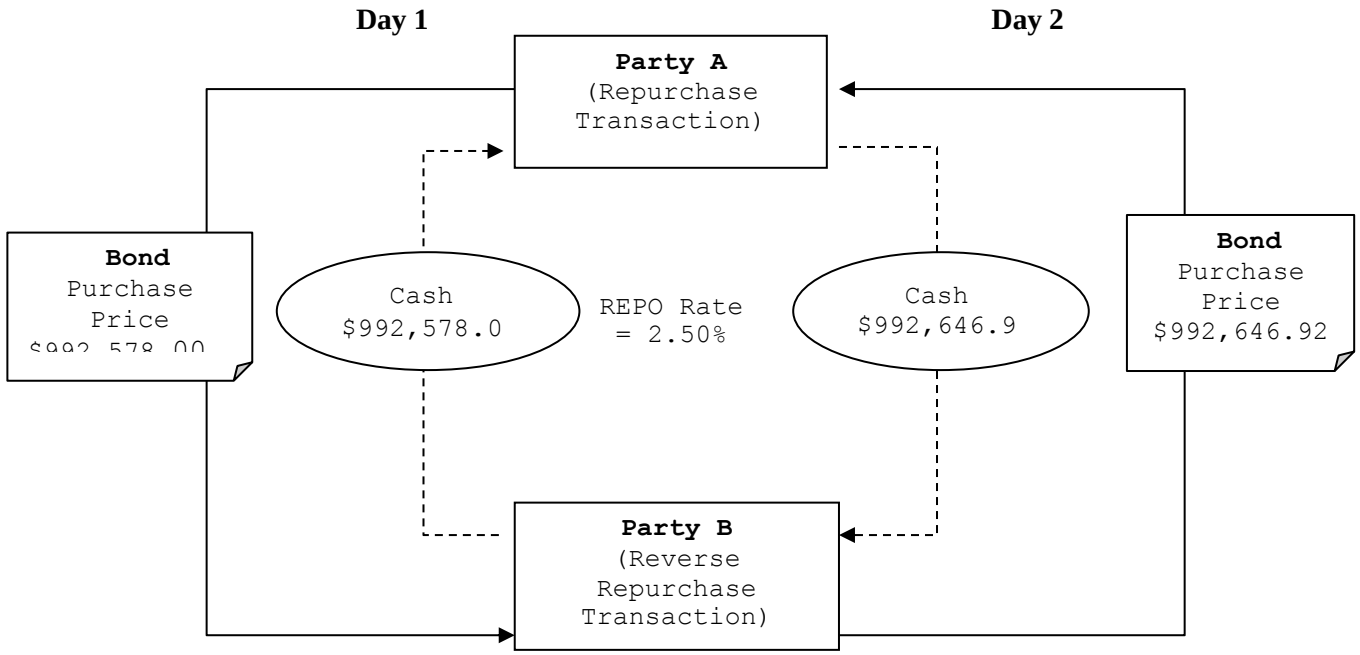
24-hour call money: This category is cash loans and deposits which have their interest rate fixed for the first seven days. Thereafter, the borrower (lender) can repay (recall) or either party renegotiate the interest rate, with 24 hours' notice. Interest is paid monthly, on the same basis as for 11.00 a.m. cash.

Term loans and deposits: Term loans and deposits have an agreed maturity and interest rate. They are usually short-term and may have fixed or (occasionally) floating interest rates. Interest is generally paid at the end of an interest period (i.e. on a rate reset date), and/or at maturity.

REPURCHASE AND REVERSE REPURCHASE AGREEMENTS (REPO AND REVERSE REPO)
A repurchase (reverse repurchase) transaction involves the sale (purchase) of a debt instrument with a simultaneous agreement to buy (sell) it back at an agreed price at a future date.

This is illustrated in the below chart:

Repurchase Transaction



In this example, a bond is sold at its current market price of $992,578.00, determined by using the bond price formula and market yield. It is bought back the next day at a price calculated as the sale price ($992,578.00), plus one day's simple interest at the repo rate of 2.50% ($992,578 x 0.025 / 360 = $68.93), giving the repurchase price of $992,646.92.

Repo transactions that have a set maturity are known as 'term' repos. When no specific maturity date has been determined, they are known as 'open-dated' or 'at-call' repos. Most repos traded are at call, and have an effective maturity of overnight.

The current criteria for repos are:

- Securities issued by foreign governments and government agencies that have an explicit Government guarantee
- Securities of supranational organisations, foreign governments and government agencies will be eligible where both the securities and the issuer have an AAA rating.

Repo transactions are used for three main purposes:

As a source of cheaper short-term funds
Borrowers holding a portfolio of bonds can use it for repo transactions to raise short-term funds at a rate better than that obtainable by taking standard unsecured short-term deposits. This is because the lender effectively has a secured loan, which uses less credit if, as is usually the case, the stock has a higher credit rating than the borrower.

As a secure investment of excess funds
The opposite side of the above transaction is the lender, who is able to lend on a secured basis, and therefore incurs less credit risk than in an unsecured lending arrangement.

As a way of covering a short sale
Stock shortage resulting from the short sale of a security (i.e. a sale without physically holding the instrument) which is approaching settlement date, can be covered by a repo. Under the repo agreement, legal title passes from the vendor to the purchaser, allowing the purchaser to sell the stock as required. This transaction still maintains the

seller's short position, as delivery has effectively been deferred to the date of the second leg of the repo. Entering a reverse repo and then selling the stock can open up a short sale position.

The debt instrument underlying a repo is important as the creditworthiness of the collateral is the basis for its price, and can be categorised as:

General collateral
Stock that is not specific, and meets the cash lender's requirements as to credit quality and maturity – and can be used for collateralised borrowing and lending.

Specific collateral
This type is required when a repo is being used to cover a short sale, as a specific stock (i.e. issuer, maturity, coupon etc) is required to meet delivery.

BILLS OF EXCHANGE
A 'bill of exchange' is defined in the *Bills of Exchange Act 1909* [Part II Division 1: 8 (1)] as:

> *'… an unconditional order in writing, addressed by one person to another, signed by the person giving it, requiring the person to whom it is addressed to pay on demand, or at a fixed or determinable future time, a sum certain in money to or to the order of a specified person, or to bearer.'*

A bill of exchange is therefore the 'securitised' evidence of a debt, repayable by the 'addressee' to a specific person or to bearer (the holder of the bill).

- The parties to a bill of exchange are: **the drawer**, who is the person seeking funds and therefore requiring the bill to be drawn up.
- **the acceptor, who** is the party which is accepting liability to pay the proceeds of the bill at maturity. The acceptor is generally a financial institution such as a bank. This attaches a higher credit rating to the bill, making it more acceptable to investors, and therefore more easily negotiated, than would be the case without bank bill status. The purchaser of a bank bill does not need to have knowledge of the drawer, as credit risk is with the accepting bank.
- **the payee** is the person to whom the funds are to be paid by the acceptor at maturity. It may be the drawer, or any other person or to bearer.
- **the discounter** is the party who buys the bill, thereby providing funds to the drawer. Often this is the accepting bank.

The initial term to maturity of bills of exchange is usually seven to 365 days (one week to one year).

TYPES OF BILLS OF EXCHANGE:

- **Bank accepted bill (BAB)**: These are bills accepted by a bank as described above.

PROMISSORY NOTES (PN's)
Promissory notes, also known as 'commercial paper', are defined in the *Bills of Exchange Act 1909*, section 89, as:

> *'…an unconditional promise in writing made by one person to another, signed by the maker, engaging to pay, on demand or at a fixed or determinable future time, a sum certain in money, to or to the order of a specified person, or to bearer.'*

As with a bill of exchange, a promissory note is the *securitised* evidence of a debt. However, the fundamental difference to a bill is that a promissory note does not have an acceptor and the credit risk to the holder lies solely against the issuer. For this reason, promissory notes are also known as 'one-name paper'.

The parties to a PN are the:

- 'issuer'
- 'payee', who may be either a specified person or the bearer. Most promissory notes are payable to bearer. If a specific payee is named, that payee must assign title of the note through instruction and signature. That instruction may be to pay another specified person or to bearer.

The main issuers of conventional promissory notes are non-bank financial institutions, and large corporates with high credit ratings.

Asset-backed securities have become a significant sector of the promissory note market. These structures allow illiquid or term assets (e.g. housing mortgages, credit card receivables, debt portfolios) to be pooled in a special purpose vehicle, which then issue short-dated securities backed by the underlying assets.

These instruments are traded at a margin relative to bank bills .The margin is based primarily on credit rating and liquidity, where the credit rating might be derived from a variety of measures including collateralisation, subordination (i.e. the seniority or ranking of the claims within a structure) or credit enhancement.

Negotiable certificates of deposit (NCDs): NCDs are promissory notes issued by a licensed bank. As with PNs, the credit risk is with the issuer. They are interchangeable with BABs in the professional market, and trade at the same yield as BABs of similar term to maturity.

Euro commercial paper (ECP): ECP is commercial paper, or a promissory note issued outside of the issuer's/borrower's country of domicile. It is usually offered through a program and marketed by a dealer panel. ECP investors are primarily ratings driven.

LONG-TERM DEBT PRODUCTS

The long-term debt market can be divided into two market segments, commonly referred to as the fixed interest and debt capital markets. The fixed interest or bond market as it is also commonly referred to consist of debt issued by government financing agencies.

The debt capital market, or the corporate bond market, as it is also commonly referred to, consists of debt issued by non-government entities including banks, finance companies, large corporations, and special purpose companies.

Long-term debt products have initial terms to maturity of one year or more, and generally:

- pay interest at discreet intervals (usually three or six monthly) to the investor over the life of the security (the exception being zero-coupon bonds)
- are usually registered rather than negotiable or transferable, so that the issuer is able to identify who is entitled to receive the periodic coupon interest. Some bonds have been issued as bearer instruments, but these are no longer common.

GOVERNMENT BONDS

Government bonds (or GS) are issued by the government, primarily to satisfy the Government's long-term funding requirements. Even when the government is running budget surpluses and has no new funding requirements, debt will still be issued in moderate amounts to maintain liquidity, and efficiency, in GS markets.

As they are issued by the government, they carry an AAA rating, and as such represent a long-term, highly secure investment vehicle. The GS yield curve forms the pricing and risk benchmark by which all long-term debt is issued, i.e. most issuance and trading in longer dated debt is done so relative to 'bond'.

They are issued via the Government Authority on a competitive tender basis. The government will conduct tenders on an outright basis.

NON-GOVERNMENT SECURITIES

Banks, finance companies and corporations issue non-government securities. Volumes of such securities on issue have increased over the past several years, driven by a combination of:

- the reduction in the level of government bonds on issue, causing an increase in the demand for corporate bonds. The reduction of the level of government bonds on issuance, per se, does not increase the need for corporations to issue, but the pricing of the issues has become more attractive
- Foreign markets and investors have become more global in outlook with either the investors coming to the new market, or issuers going to the much larger European or US markets ('144a' or 'RegD').
- increasing requirements by the corporate sector for investment in fixed income assets. With increasing flows into superannuation funds, fund managers are seeking assets which better match liability maturity profiles.
- increasing acceptance of securitisation techniques and credit derivative technology has also brought new asset classes to the market. Securities backed by asset classes such as residential mortgage, commercial mortgages, credit card receivables, automobile loans, credit derivative/collateralised debt obligations have all been issued into the bond market's.

Most non-government issues are bought to the market by lead managers on behalf of the issuer.

Like government issuance, the majority of non-government issuance is fixed rate, and where possible non-government securities follow the same market conventions that apply to government securities. However, as they are more tailored to the borrower's needs, this is not always applicable.

Trading in non-government securities is credit-driven. By far the greatest volume of issuance is in investment grade (i.e. rating BBB- or stronger), with even BBB- to BBB+ names struggling to find volume demand. This has led many weaker investment grade companies to take their issuance off shore. Where they do have the same characteristics of government securities, their yield to maturity is expressed as a spread to bond (with the nearest maturity). This spread represents credit spread differentials, and varies over time. Trading bonds to take advantage of movements in absolute or relative credit spreads is an important part of this market.
Long-term debt products are structured in various ways, depending on the objectives of the instrument. The most common structures are described in the following sections.

FIXED INTEREST SECURITIES
Fixed interest (or fixed rate as they are also referred to) issuance represents the majority of issuance in the long-term debt market. Generally for ease of issuance and for the liquidity provided by an underlying government debt market, issues normally adopt the characteristics of Treasury bonds that:

- have a face value which is repaid at maturity
- pay a fixed coupon in arrears, every six months over the life of the bond
- can be cum or ex-coupon

To allow sufficient processing time, coupons are paid on the due date to the owner as registered seven days prior ('books closed date'). Pricing between this date and coupon payment date will reflect that no coupon is accruing.

- typically have initial terms to maturity of between one and 15 years
- trade at a discount or premium, depending upon whether the coupon rate is respectively below, or above, the current market yield
- are registered (inscribed) securities

ZERO-COUPON BONDS
Zero-coupon bonds are usually long-term discount securities. There are no interim cash flows and all interest and principal (face value) is paid at maturity. As a result, the interest (discount) element is large compared to face value, and consequently these instruments are also known as 'deep discount' securities. Waiting until the maturity date for principal and interest repayment significantly increases the risk of repayment default, so demand is less than that for coupon instruments. Companies, such as hi-tech firms, which may have weak initial cash flows, but significant potential for growth, may issue such securities to strengthen company cash flows in the short-term.

THE YIELD CURVE
The level of interest rates or yields varies with the maturity term. This relationship between interest rate levels and maturity term is **the term structure of interest rates**. This can be plotted in a graph showing yield against maturity. The resulting graph is called the **yield curve**. The most commonly observed shape of the yield curve is a positively sloping line, with yields rising with increasing maturity. This is known as a positive or rising yield curve. The shape of the yield curve may be different at different times resulting from different conditions in the market at that point of time.
Other yield curve shapes observed include declining, flat and even humped yield curve shapes. (See Figure 1.8.1)

SOME EXPLANATIONS OF YIELD CURVE SHAPES

Expectations:
The levels of interest rates are determined by expectations of what they will be in the future. If interest rates are expected to be higher in the future, then longer term interest rates will be higher than shorter dated ones. For example, if the level of 3 months' rates is expected to rise over the next 3 months, then this will be reflected in a higher 6-months' rate to day since a 6-month deposit will become a 3-month deposit in three months' time. Conversely, if rates are expected to fall, the yield curve will exhibit a declining shape.

Liquidity:
Market participants demand a higher rate for less liquid investments, i.e. a **liquidity premium**. Therefore, rates for longer maturities will be higher than shorter maturities. This will explain the more frequent observation of a rising yield curve.

Market Segmentation
According to this explanation, the level of interest rate at any point on the yield curve reflects the balance of demand and supply of funds. There are certain providers of funds or borrowers of funds, who for various reasons prefer to lend or borrow at particular parts of the yield curve. For example, insurance companies tend to be providers of funds at long maturities to create assets to match their long term liabilities. Money market funds will

only be providers of funds at the short end of the curve. Similarly, different types of borrowers will have different maturity preferences. The market segmentation explanation says that the different types of lenders and borrowers can be segmented according to their preferences for different maturities along the yield curve. The relative balance of supply and demand stemming from these market segments accounts for the variation in interest rate levels across maturities.

METHOD & PSYCHOLOGY OF TRADING

METHOD

What steps do you follow to succeed as a trader? No method will work all of the time. Any method, and therefore, any trader will sustain losses from time to time. The key is to find a method with which you are comfortable and use it.

Arrange your ideas in an **orderly** fashion. These will involve analysing the fundamentals, using technical analysis, relying on gut feel and using all of the information that is available to you.

By being **consistent** in your method you can evaluate your good and bad trades. You can learn from them and fine tune your method over time as your experience grows.

IF IT WORKS FOR YOU - IT WORKS!

You can learn from other people but don't just try to replicate other successful traders. What works for someone else, won't necessarily work for you. Everyone is different. Pick out successful role models from whom you can learn, use some of their principles whilst developing the methods that work for you.

EXPERIENCE

Experience is the best teacher. No formal education, training or paper trading will teach you what it feels like to lose money, to make money, give away a profit, fight back from a loss or miss a big move that you have been looking for. However, learning, reading, participating in courses, seeking out contacts and on-desk training will accelerate the process of experience-driven learning with dramatic results.

PSYCHOLOGY

Psychology is the science of the nature, functions and phenomena of the human mind.

CONFIDENCE

You need confidence to act decisively. Having a method that works for you and the experience to use it correctly should provide you with the confidence to put your skills to the test.

DISCIPLINE

"Unbridled confidence is a sure-fire recipe for disaster"

Your knowledge-reinforced confidence can be tempered by the following forms of discipline:

(1) The discipline to recognise a position for what it is and follow through appropriately <u>when</u> you enter or exit that position.

If you plan a 30 point short squeeze with a 10 point stop loss, don't run your loss when the squeeze doesn't eventuate and turn it into a new strategic positioning opportunity. If your plan is for a strategic positioning opportunity and someone takes the position off you, get in again if nothing else has changed.

(2) The discipline to recognise when you are wrong. When all that's left is hope and luck and when the circumstances affecting the reasons for you entering the trade have changed, then, **<u>GET OUT!</u>**

(3) The discipline to not be greedy. When the market reaches your original objective, take profit. Leave something for the next guy. Alternatively, don't square up too early just to book a profit, unless your market read has actually changed for some reason. Don't wait for your stops to cut bad positions and take profit before your objectives are met for good positions.

(4) The discipline to say no. Have the discipline to say no when faced with boredom peer pressure (I don't want to miss the party), pub or noise trades.

(5) The discipline to balance loss cutting with profit taking. If you are a price maker you must resist the 1 or 20 point cut scenarios to be successful. (I.e. 1 point profit or 20 point loss)

(6) The discipline to stay out of the market when you know you can't be focused because of personal reasons.

(7) 'The discipline to pay a spread. If you have a strategic plan, pay the spread. Don't bid and offer. If you are right, the spread you pay away in execution will be dwarfed by what you make on the trade.

(8) The discipline to persevere. You will have losing trades. Losses are OK if you have stuck to your trading plan.

(9) The discipline to be flexible. Let new news change your view. Don't lock yourself into a one-way train of thought. That is a recipe for disaster over time. You must continually evaluate the landscape as it changes and apply these changes in the context of how it affects your position and the original reason you took the position.

MONEY MANAGEMENT
You must respect the return on risk and the return on expenses that you are generating for your bank and respect the functions of customer service that you are asked to perform for your bank.

There are innumerable speculators working for institutions who get away with using no money management practices because their loses somehow get lost in the general P & L of the room or their profits on customer dealings pay for their undisciplined trading.

Money management ensures that your capital-risk per trade does not put you financially or psychologically out of commission.

Establish an amount that will be your maximum loss and when you are under water by that amount **GET OUT**. There is no telling how much worse it will get and while you have capital left you can trade again.

When you establish your maximum loss you should also establish a realistic profit objective. The potential profit must be large enough to justify the amount of capital that you are risking.

Maintain the same principles with the bank's capital that you would with your own. Because the bank trusts you to use discipline and to allocate their capital in a responsible manner, you must respect some form of money management to justify that responsibility.

SUMMARY
If you have method, experience, confidence and discipline but fail to practice money management techniques, you may run out of capital before you get the chance to succeed.

OPERATIONAL RISK

INTRODUCTION

The BIS made the following statement on Operational Risk:

“Managing such risk is becoming an important feature of sound management practice in modern financial markets. The most important types of operational risk involve breakdowns in internal controls and corporate governance. Such breakdowns can lead to financial losses through error, fraud, or failure to perform in a timely manner or cause the interests of the bank to be compromised in some other way, for example, by its lending officers or other staff exceeding their authority or conducting business in an unethical or risky manner”.

DEFINITION OF OPERATIONAL RISK
Operational risk - is the risk of losing money as a result of failures in systems or procedures.

OPERATIONAL RISK INCLUDES:

Settlement risk: the risk that you deliver funds to your counterparty and they do not deliver funds to you.

Systems risk: the risk of loss due to computer failure. This could involve an incorrectly programmed formula, a logical error in the program (e.g. Y2K bug) or corruption of data due to a virus.

Legal risk: the risk that you lose money because contracts are not legally enforceable or you incur damages for negligent behaviour.

Accounting risk: the risk of loss due to incorrect accounting treatment or reporting of P & L.

Business interruption risk: risk of loss due to a power failure, train strike etc

Reputation risk: the risk of loss of business resulting from bad publicity

People risk: the risk loss due to a person failing to follow correct procedures. This may be deliberate (fraud) but it is mostly unintended. People risk also includes the risk of key people leaving the bank without adequate back-up.

SETTLEMENT RISK IN FOREIGN EXCHANGE

Settlement risk (also called delivery risk) is the risk that counterparty takes delivery but fails to pay. Settlement risk occurs when there is a non simultaneous exchange of items of equivalent value between counterparties.

For foreign exchange transactions settlement risk applies from the time payment of one currency is made to the counterparty until good funds are known to be received in the other currency from the counterparty. Because payments are made into bank accounts which may be in other countries and possibly in different time zones, it is frequently the case that payments cannot be made simultaneously. For example, if a company in the Japan sells NZD against USD to a British counterparty, the NZD will be paid into the British company's account with a bank in New Zealand before the close of business in New Zealand but it cannot receive the USD into its bank account in the U.S. until New York business hours. There is at least an 8 hour delay. Further, by the time the USD is credited to the Japanese company's New York account, it will be well into the Japanese night. People in the company in Japan are not likely to be aware that they have received good funds until the next morning their time. If there is a time lag between when funds are received and confirmation that they have been received (e.g. they may not receive a statement showing that the USD have been received until the following day) then the settlement risk applies for a longer period.

Settlement risk is predominantly operational risk. Good systems enable a bank to know at the earliest possible time that it has received payment from its counterparty.

TECHNIQUES USED TO MANAGE SETTLEMENT RISK.
Steps have been taken within the industry to reduce the settlement risk

By far the greatest change to counterpart settlement risk has been the advent of the CLS Bank. Continuous Link Settlement (CLS) members (there is a membership fee) enter their trades into the system, and these are matched. Any cash flows arising from the matched trades are netted, with netted cash flows being settled daily through accounts the institutions hold with the CLS Bank.

Another method used by the industry is where two institutions will net of payments and receipts in various currencies occurring on the same day and settling only the net cash flow.

POSITION KEEPING
Buying and selling foreign currencies create exposures to changes in exchange rates.

Buying a foreign currency creates an asset. The position is said to be **long** the foreign currency. If the foreign currency appreciates there will be an exchange profit. If the currency depreciates there will be an exchange loss.

Selling a foreign currency creates a liability. The position is said to be **short** the foreign currency. If the foreign currency depreciates there will be an exchange gain. If the foreign currency appreciates there will be an exchange loss.

The excess amount of a foreign currency which has been purchased over the amount of the same foreign currency which has been sold is described as the **net exchange position**. There is a separate net exchange position for each foreign currency.

Net Exchange Position = foreign currency purchased - foreign currency sold

A net exchange position is created or removed at the time at which the purchase or sale of foreign currency is contracted, not at the time at which the related cash flows occur. For example, if a spot contract is entered into today to purchase EUR 1,000,000 against USD at a rate of 1.3510, the buyer immediately becomes long EUR and short USD regardless of the fact that they will not receive EUR nor pay away USD until two business days later. Similarly, forward purchases or sales of foreign currency immediately create or remove a net exchange position.

It is the dealer's responsibility to ensure that they always know their position. These days' front office systems facilitate the accurate tracking and revaluation of positions. However, the system will only report the position correctly if all deals have been correctly and completely input.

It is the responsibility of the back office to verify that positions have been correctly kept by reconciling deal confirmations and bank balances with reported positions.

Substantial losses can occur when the dealer has a position which is different from what they think. For example, if a deal to buy EUR 10,000,000 is incorrectly input as a sold transaction, the system may show the net position as square when in fact the bank is long EUR 20,000,000. If the EUR falls before this is identified and the unintended position closed out, then large losses can materialise.

Incorrect position keeping can also give rises to losses through penalty charges on overdrawn accounts or because of uninvested (i.e. earning no interest) cash balances.

A cardinal rule of trading is for the dealer to know their position at all times.

ROLE OF THE BACK OFFICE

Every transaction involves the following stages: - initiation, execution, booking, confirmation, revaluation, reconciliation and settlement. When problems arise there are also the steps of investigation and resolution.

The separation of duties and independence between front and back office minimise the risk of error and fraud. Initiation, execution and initial booking are performed by the front office. The back office performs the role of checking the deals have been correctly booked, confirmations, revaluation rates, reconciliation and settlement as well as investigations when necessary.

The principle of maker/checker is that the risk of error is greatly reduced if someone checks what has been done.

CONFIRMATIONS

Most foreign exchange deals are simple contracts. A bank buys a specified amount of one currency and sells the counter value of another currency to counterparty and they agree on when settlement will occur and through which bank accounts. Some deals e.g. exotic options involve much more detail.

It is important that deals are processed efficiently and quickly. This is partly because potential losses will be much less if errors are detected early. It makes sense to automate as much of the process of confirmation, booking, settlement and reconciliation as possible.

Wherever practical standard settlement instructions are used, standing instructions are given to regular counterparties that payments will be made or received through specified bank accounts. This eliminates the need to go over the settlement details every time and it minimises the risk of money being paid into the wrong account.

The use of electronic dealing means that most of the information required to process the transaction can be fed into the systems of both banks immediately and without dispute.

Whenever deals involve non standard instructions or other particulars there needs to be a comprehensive confirmation process. In the first instance this is done between the dealers. The details should then be confirmed independently by the back office.

Master agreements (e.g. ISDA with the FX addendum) are exchanged and agreed between counterparties. These define the understandings that apply to all related transactions. This enables banks to streamline the confirmation process.

SETTLEMENTS
The back office must ensure that payments are made into the correct accounts on the correct day. The back office must also check that funds expected were received on time. Banks use what are known as nostro (local) accounts. Standard settlement instructions reduce the risk of funds being paid into wrong accounts thereby avoiding penalty interest charges and reputation risk.

Automation of the settlement process helps ensure that settlements are processed quickly, accurately and cheaply.

RECONCILIATION
To ensure that positions and profits are correct a continual process of reconciliation takes place. Dealers are required to reconcile their net exchange position. The back office reconciles the Dealers position with the bank balances. Realised profits are reconciled with bank balances. Revaluation rates are independently obtained from reputable independent sources unrealised profits are reconciled with revaluation reports, positions are reconciled with approved limits, credit exposures are reconciled with approved limits and so on.

Again, the reconciliation process is improved in accuracy and speed to the extent to which it is automated.

INVESTIGATIONS
Whenever funds are not received or something does not reconcile it needs to be followed up as quickly as possible. Small problems quickly grow into big problems if they are not sorted out. Procedures are continually improved to working out where things went wrong and devising plans to improve them in future.

It is inevitable that errors will occur. People need to take care to minimise the number of errors and they must be prepared to rectify errors quickly when they happen. The worst thing that people can do is to try to cover up problems or even hope that they will sort themselves out. That is a sure fire recipe for disaster.

CONCLUSION
Closing a deal is not the end of the process - it is only the beginning. Dealers need to be mindful of the importance of the back office. The bank has not made any money until all of the tasks in the back office are successfully completed.

WHAT RISKS ARE WE RUNNING?

Trading in foreign exchange and other OTC markets involves risk as well as opportunity. The principal risks associated with trading spot, forward or options include:

Market risk: is the risk that the traded market price move's so that an open or unhedged position results in a realised or unrealised loss.

Credit risk: is the risk that a counterparty that owes money is unable or unwilling to pay.

Liquidity risk: is the risk that you are unable to execute a transaction for the full amount (or at all) without a significant adverse price movement in the market.

Reputational Risk: losing business from customers due to bad publicity (e.g.) fines from the regulators or Exchange Commission!

Operational Risks: banks ensure they have the systems in place to facilitate the settlement of transactions. Other duties include monitoring dealers only transact in markets they are approved to deal in (eg) as a manager you don't find a position you didn't know about!!

Legal Risks: ISDA documentation (which includes FX payment and close out netting) with banks & corporations you deal with to cover you in the event of default

Systemic Risk: Large scale disaster recovery type scenarios (eg) US sub prime mortgage losses and the pressure on Credit markets > Pressure on a Banking system and Central Banks have to pump in liquidity

CREDIT RISK
Historically, banks have primarily lost money as a result of credit risk. Customers to whom banks have lent money have failed to repay the loan (in full). In order to protect depositors Central banks set regulations under which commercial banks are required to maintain minimum levels of capital. The Bank of International Settlements, which is the Central Bank to the Central Banks, established a requirement that banks must maintain a minimum capital ratio. A bank's capital ratio is the ratio of the bank's capital (shareholders' equity) to its assets (loans to customers). The idea is that if some of their customers default on their loans the bank will have sufficient capital to survive.

With the massive growth in financial markets over the last 30 years, Central Banks became concerned that banks could suffer large credit losses from foreign exchange and derivatives. Indeed, one of the main reasons for the rapid growth in derivatives was that banks were keen to deal "off balance sheet" to reduce their capital adequacy requirements. Under the Basle Accord banks have to hold capital against the credit exposures arising from foreign exchange and derivative transactions.

This is known as the mark-to-market (MTM) amount.

CREDIT RISK - REGULATORY APPROACH
The BIS prescribed a methodology, called the Regulatory Approach, to dimension the credit risk and, therefore, how much capital banks were required to hold against foreign exchange and derivative transactions.

The credit risk associated with a foreign exchange transaction was expressed as loan equivalent terms. The loan equivalent amount was calculated as the replacement cost (MTM) plus an Add-On. The reason for the Add-On was that the MTM amount could increase if the rate moved further against the counterparty before the event of default. The Add-On factor was set at 0 for deals up to 14 days, at 1% of face value for deals up to 1 year and at 5% for deals beyond 1 year.

The loan equivalent amount was then multiplied by a weighting factor (0%, 20%, 50% or 100%) depending on the type of transaction and counterparty. Transactions with OECD governments were given a weight of 0% because it was assumed that they would never default. In the other extreme deals with corporate customers were given a weight of 100%.

CREDIT RISK – ECONOMIC APPROACH
The Regulatory approach is a crude method for dimensioning the credit risk. The discrete add-on factors provide simple but crude estimates of by how much the MTM amount could increase and the counterparty weightings are a crude means of providing for varying creditworthiness.

When the Regulatory approach was introduced a number of banks were already using more sophisticated techniques to quantify the credit risk associated with foreign exchange transactions. When Central Banks are satisfied that a bank's internal methodology is superior to the regulatory approach, they allow bank's to calculate their risk weighted capital requirements using their internal measures. This is known as the Economic Approach.

The economic approach typically involves a more sophisticated approach for providing for potential exposure and uses probabilities derived from historic defaults for counterparties with the same credit rating.

The potential credit risk is estimated by calculating how much would be lost if the exchange rate moves to a particular level ("stressed" rate). The stressed rate is calculated by specifying a confidence level and making an assumption about the expected volatility of the rate over the remaining life of the contract.

VALUE AT RISK – VaR
A similar approach to the economic approach for measuring credit risk can be used to dimension market price risk. **Value at Risk** is a measure of the expected loss from an adverse price movement with a specified probability over a particular period of time.

An open position, whether it is a spot position, a gap position, a volatility position or an exposure to some other market factor, can result in a loss if the price moves adversely. VaR dimensions to a specified confidence level how much would be lost given an assumed level of price volatility.

It is important to understand that the VaR is not the maximum amount that can be lost. It is the expected loss over a designated time horizon if the underlying assumptions hold. Typically, it is assumed that changes in the underlying price are normally distributed. If that is the case, there are known probabilities that the price will be above or below a certain level at a specified time.

FORWARD FOREIGN EXCHANGE

OVERVIEW

This chapter discusses forward foreign exchange. This type of foreign exchange transaction is unique, and we will examine these features before applying the principles to examples of basic forward rate calculations for outright forwards, FX and currency swaps and non-deliverable forwards. We will also examine how the interrelationships between FX and other financial market products can lead to arbitrage opportunities.

WHAT IS FORWARD FOREIGN EXCHANGE?

An forward foreign exchange transaction is one in which a currency is sold or purchased against another currency, at the forward exchange rate, for maturity on any day past the spot delivery date. It is an over-the-counter (OTC) transaction between two parties, on non-standardised terms with specified delivery dates, and settlement at the end of the contract (usually delivery of the underlying, or cash settlement).

Corporate customers (exporters, importers, margin traders, fund managers, etc.) use outright forwards to hedge their foreign exchange exposures. Banks quote outright forwards to customers, but not to each other. Between banks the transactions are usually FX swaps

An 'FX swap' is a combination of a near and far-dated forward foreign exchange transaction, where the far-dated exchange is the reverse of the near-dated one. The principal amounts of two currencies are exchanged on a specific date at a rate agreed at the time of the conclusion of the contract (short leg), and at a date further in the future at a rate agreed at the time of the contract (long leg).

FURTHER TERMINOLOGY

To briefly recap:

- An over-the-counter transaction (OTC) is a private, tailor-made, non-standardised agreement between two parties for a specific delivery, at a specific price for a specific date in the future. These contracts are not traded on a formal exchange or formally regulated by overseeing agencies or clearing houses.
- The 'contract date' is the date on which the trade is agreed.
- the 'forward date' is the date where settlement is for a business day greater than the spot date
- Forward contract counterparties are known as buyers and sellers.

FORWARD EXCHANGE RATE

Forward rates differ from spot rates, because they have to take into account the interest rate differentials between the two currencies for the period of the contract.

Example 1:

For example, assume the spot rate is USD 1 = JPY 98.10 and 6-month (180 days), USD and JPY interest rates are 0.35% per annum and 0.15% per annum respectively. The 6-month forward exchange rate is thus calculated as follows:

On the spot date USD 1,000,000 = JPY 98,100,000. By the end of the 6-month period:

- USD 1,000,000 would be worth 1,000,000 × (1 + [0.0035 × 180/360]) = USD 1,001,750
- JPY 79,500,000 would be worth 98,100,000 × (1 + [0.0010 × 180/360]) = JPY 98,149,050

The 6-month forward exchange rate would be:

$$\text{USD } 1{,}001{,}750 = \text{JPY } 98{,}149{,}050$$

$$\text{i.e. USD } 1 = \frac{98{,}149{,}050}{1{,}001{,}750}$$

$$= 97.978$$

In general:

$$\text{Forward rate} = \frac{\text{forward value of term currency}}{\text{forward value of base currency}}$$

Forward Exchange rate formula:
The general formula can be expanded to:

$$f = s \times \frac{(1 + r_T t)}{1 + r_B t}$$

Where:
f = forward exchange rate
s = spot exchange rate
r_T = interest rate of term currency
r_B = interest rate of base currency
t = time period in years

Derivation of Forward Exchange Rate formula:
By definition, the forward rate is the ratio of the forward value (or future value) of the term currency to the forward value of the base currency.

$$f = \frac{FV_T}{FV_B}$$

Similarly, by definition the spot rate is the ratio of the present value of the term currency to the present value of the base currency.

$$s = \frac{PV_T}{PV_B}$$

When simple interest rates apply, the future value is calculated using:

$$FV = PV(1 + rt)$$

Where:
PV = present value
r = interest rate % pa
t = time in years

$$f = \frac{FV_T}{FV_B} = \frac{PV_T(1 + r_T t)}{PV_B(1 + r_B t)} = \frac{s(1 + r_T t)}{(1 + r_B t)}$$

If the time period is expressed in days:

t = d/dpy

Where:
d = number of days
dpy = days per year

Therefore:

$$f = \text{Spot} \times \frac{(1 + r_T \times \frac{d}{dpy})}{(1 + r_B \times \frac{d}{dpy})}$$

Generalising:

t = p/ppy

Where:
p = period
ppy = periods per year

For example, when considering quarterly periods - ppy = 4; monthly periods - ppy = 12
Weekly periods - ppy = 52; and so on.

FX swaps:
An FX swap transaction is the simultaneous purchase and sale of equivalent amounts of one currency against another currency for different maturities — usually the execution of a spot (near-dated) and outright forward (far-dated) transaction simultaneously. Note that these swaps are often called ‘forwards’ in the market as well, which can lead to confusion. We’ll use the correct technical terms in this chapter.
The difference between the forward exchange rate and the spot rate is known as the ‘forward margin’ or ‘FX swap points’:

Forward margin = forward exchange rate – spot rate

i.e. forward margin = spot rate x $\frac{(1 + r_T \times \frac{d}{dpy})}{(1 + r_B \times \frac{d}{dpy})}$ - spot rate

where:

r_T	=	interest rate of the term currency
r_B	=	interest rate of the base currency
d	=	number of days in the period
dpy	=	number of days per year

Example 2

Continuing on from Example 1:

Forward margin	=	97.978 – 98.10
	=	– 0.122 or –12.2 forward points

If the forward margin is positive, the base currency is said to be at a 'forward premium' (the forward price is HIGHER than the spot price). If the forward margin is negative, the base currency is said to be at a 'forward discount' (the forward price is LOWER than the spot price)

FORWARD DISCOUNTS:

In Example 2 above, the forward margin is a negative number, indicating that the base currency (USD) is at a forward discount against the term currency (JPY). That is, the forward price of USD/JPY is less than its spot price USD/JPY. This reflects the fact that the USD interest rate is higher than the JPY interest rate.

The higher interest rate currency will be at a forward discount against the lower interest rate currency.

FORWARD PREMIUMS:

In Example 3 below, the forward margin is a positive number, indicating that the base currency (AUD) is at a forward premium against the term currency (NZD).

Example 3

Spot	AUD/NZD	1.1250
6-month (184 days)	AUD interest rate	2.80% pa (365 dpy)
6-month (184 days)	NZD interest rate	2.90% pa (365 dpy)

At the spot rate, AUD 1,000,000 = NZD 1,125,000.

After 6mth (184 days), AUD 1,000,000 would accumulate to a forward value of AUD 1,014,115.07

Forward value	=	Principal	+	Interest
	=	1,000,000	+	1,000,000 × 0.028 × 184/365
	=	1,000,000	+	14,115.07
	=	1,014,115.07		

Similarly, NZD 1,125,000 would accumulate to a forward value of NZD 1,

Forward value	=	Principal	+	Interest
	=	1,125,000	+	1,125,000 × 0.029 × 184/365
	=	1,125,000	+	16,446.58
	=	1,141,446.50		

Thus, forward rate = $\frac{\text{forward value of term currency}}{\text{forward value of base currency}}$

= $\frac{\text{NZD } 1{,}141{,}446.50}{\text{AUD } 1{,}014{,}115.07}$

i.e. 6mth AUD/NZD	=	1.125559		
Forward margin	=	forward rate – spot rate	=	1.125559 – 1.12500
	=	0.000559 or	+	5.59 forward points

The forward price of AUD/NZD is HIGHER than the spot price for AUD/NZD. This reflects the fact that the AUD interest rates are LOWER than the NZD interest rate.

Most countries have their interest rates based on a 360 day count and others (e.g. Australian and some Commonwealth countries) are based on 365 day count.

FORWARD BID AND OFFER RATES:
Forward prices are quoted as bid and offer prices:

1 month	18.50 / 18.40
3 month	57.00 / 56.50
6 month	109.00 / 108.50
9 month	164.00 / 163.00
12 month	220.00 / 218.00

To understand on which side to deal, think in terms of the forward settlement. The bid is the price at which the price-maker will buy the base currency at the forward date. The offer is the price at which the price-maker will sell the base currency at the forward date.

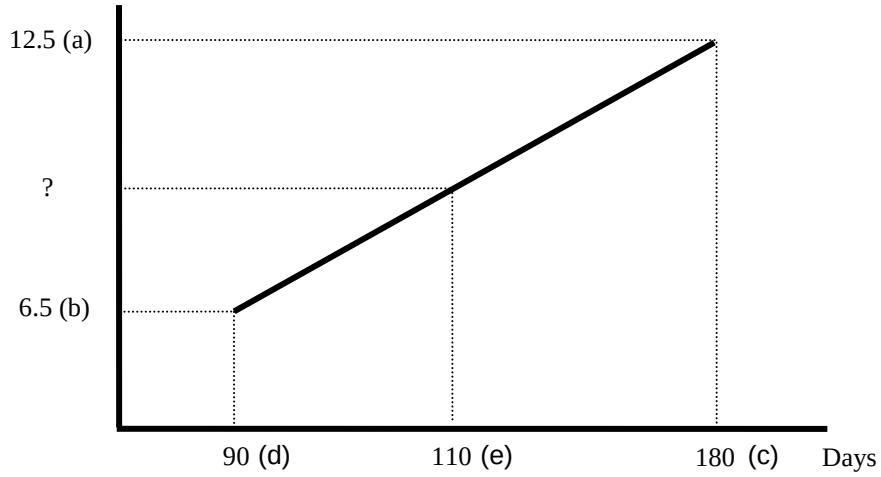
Forward value dates for whole months are the corresponding value date to the spot value date. For example, assume that today is Monday 22 July, so spot value is Wednesday 24 July. 2 months over spot would be Tuesday 24 September; 3 months over spot would be Thursday, 24 October, etc. We usually adopt a modified following day convention, except for end/end dates. If today was Monday 29 July, spot would be Wednesday 31 July; the 1 month over spot would be Friday 30 August, as it is the last working day in August

Interpolation:
In practice, forward rates are quoted for whole months as shown previously. Rates for odd dates are determined using straight line interpolation. (Interpolation means finding a point between two other points.)

Example 4
To calculate the forward bid rate for 110 days over spot, use the 3-month (90 days) rate of 6.5.0 points, and the 6-month (180 days) rate of 12.5.0 points.

This is shown graphically in Figure 4 below:

Figure 4 Linear interpolation



$$\left(\left(\left(\frac{a-b}{c-d}\right)\times(e-d)\right)+b\right) = \left(\left(\frac{12.5-6.5}{180-90}\right)\times(110-90)\right)+6.5$$

c = (0.066666 × 20) + 6.5

c = 1.33 + 6.5

110-day forward rate = 7.83

FORWARD CROSS RATES:
Forward prices for cross rates can be derived from the spot and forward prices of the two currency pairs.

Example 5:
Forward cross rate calculation

Spot	USD/JPY 98.10		AUD/USD 0.9410
3-month forward margin	– 5 points		- 56.5 points
3-month forward rate	98.05	=	0.93535
Spot cross rate - (AUD/JPY)	98.10 × 0.9410	=	92.312
Forward cross rate – (AUD/JPY)	98.05 × 0.93535	=	91.711
Cross-rate forward margin		=	92.312 – 91.711
		=	- 0.601 or - 60.1 points

The AUD is at a forward discount of 91.711 points against the JPY.

The forward margin of the cross rate cannot be determined directly from using the forward margin, because forward margins are not exchange rates — they are differentials.

WHEN TO USE FORWARD FOREIGN EXCHANGE TRANSACTIONS

FORWARD FOREIGN EXCHANGE
Forward transactions are primarily used by importers, exporters, borrowers and investors to hedge foreign currency exposures (translation risk) triggered by import payables, export receivables, foreign currency loans and borrowings.

Example 6
In this example, an exporter needs to buy EUR and sell USD 10,000,000 value in six months.

Spot	1.3510 / 12
6-month forward margin	0.00055 / 0.0006
Forward rate	**1.35155 / 1.3518**

The exporter could sell USD 10,000,000 and buy EUR 7,397,544 using a forward rate of **1.3518**

$$\frac{\text{USD } 10{,}000{,}000}{1.3518} = \text{EUR } 7{,}397{,}544$$

FX swaps — use in arbitrage
Understanding the relationship of interest rates to forward swap points permits dealers to take advantage of windows of opportunity when anomalies in the two markets occur. Sometimes, for one reason or another, the forward swap market and interest rate markets move in separate directions. This could be due to either:

- excessive demands made during the day in one market, but the other has not yet reacted
- different views of the direction of the two markets

If a window of opportunity (arbitrage) opens, it is quickly closed as the two markets are brought back into line.

Relevant formulae:

To borrow **base** currency: $r_B = [\{(1 + (r_T d/t))\ s/fr\} - 1]\ t/d$

To borrow **term** currency: $r_T = [\{(1 + (r_B d/t))\ fr/s\} - 1]\ t/d$

FX swaps can also be used to roll foreign exchange exposures from one period to another. Say, for example, an importer had already covered their foreign exchange exposure using an outright forward transaction. They were expecting the goods to arrive on a certain date, but have now been advised they have been delayed by two weeks. The importer can use the FX swap market to roll their payment out to the new delivery date.

NON-DELIVERABLE FORWARDS (NDFs)
Non-deliverable forwards (NDFs) are outright forward transactions. A (notional) principal amount, FX rate, maturity date and rate fixing and settlement methodology are all agreed at the contract's inception.

The parties to the NDF contract settle the transaction, not by delivering the underlying pair of currencies, but by making a net payment in the base currency (typically the USD) proportional to the difference between the agreed forward exchange rate and the subsequently realised spot fixing. NDFs are also distant from deliverable forwards as they trade outside the direct jurisdiction of the authorities of the corresponding currencies, and their pricing need not be constrained by domestic interest rates.

The NDF market can be used as an alternative hedging tool for foreign investors with local currency exposure, or as a speculative instrument for taking positions offshore in the local currency. The use of NDF markets by non-residents in part reflects restrictions on their access to domestic forward markets. However, in some cases, onshore players are also important counterparts in the NDF market of the home currency. The NDF markets for some currencies have existed at least since the mid-1900s. Tightening of controls after the Asian crises may have boosted their growth in some cases.

Benefits of NDFs
NDFs allow market participants to take on, or hedge against FX exposure in currencies where there may not be access to the local markets, or where access is restricted because of illiquidity or regulatory/settlement constraints. NDFs may also suit investors who would like to take advantage of yields in certain markets, but do not want to buy local currency-denominated, or locally traded, securities.

NDFs are an asset-efficient method of managing FX exposure, as there is no actual exchange of principal funds. They avoid settlement, and therefore settlement risk.

They are not conditional upon the FX regime being maintained (apart from the fixing at maturity), so they are devoid of country or local market risk.

There is no bid/offer spread on maturity, as the contracts are normally settled against a fixing rate.

When NDFs are used
NDFs are used in the following instances:

- When there are regulatory limits — in the absence of a local forward market, or when there is limited foreign access to local currency markets.
- If there is limited liquidity in the market
- Where risk needs to be managed. This can include local counterparty risk, settlement constraints and the difficulty/cost of holding accounts in local currencies.

NDF settlements
Net cash settlement is effected in the base currency, and is the difference between the contract rate and the fixing rate.

The fixing rate is generally published on Thomson Reuters, for example:

If no rate fixing is available, the fallback is to obtain rates from leading banks in the relevant market for a quote. The results are averaged and this becomes the fixing rate for settlement.

Example 7: Transactional exposure
Three months from now, a client has to pay a supplier 2.57bn in Korean Won (KRW) and wants to hedge against the risk of a stronger KRW against the USD. The client enters into the following NDF deal with Bank A to buy KRW against USD:

Principal amount:	KRW 2.570 billion
Term:	3 months
Contract (fwd) rate:	USD1 = KRW 1090.00
Fixing rate reference:	Reuters page ‘KFTC18’
	Two days before maturity

Maturity 1

USD/KRW	KRW stronger (appreciated)
Contract rate	1090.00
Equivalent USD amount	$2,357,798
Fixing rate	1050
Equivalent USD amount	$2,447,619
Settlement	Bank A pays client

- Client would receive from the bank a settlement benefit of USD 89,821. (Difference between the contract rate and the fixing), although the client still has a small exposure to a timing basis risk between the physical spot rate achieved and the NDF fixing rate.

Maturity 2

USD/KRW	KRW weaker (depreciated)
Contract rate	1090.00
Equivalent USD amount	$2,357,798
Fixing rate	1120.00
Equivalent USD amount	$2,294,643
Settlement	Client pays Bank A

- Client would pay away to the bank a settlement of USD 63,155. (Difference between the contract rate and the fixing), although the client still has a small exposure to a timing basis risk between the physical spot rate achieved and the NDF fixing rate.

It is possible to close out a non-deliverable forward early by agreeing on a rate at which the transaction will be reversed. It is also possible to have NDFs in currencies other than USD (GBP/PHP), provided the bank and the customer agree on a reference rate for the purposes of calculating the net settlement.

FX OPTIONS

INTRODUCTION

Foreign currency options provide alternatives for management of currency exposures. In the prior modules, we explored the use of forward contracts as a hedging tool. These work well to offset a particular exposure and eliminate risk, but because the exchange rate is set by the terms of the contract, any opportunity for gains is also eliminated should the markets move in a favourable direction. Using options as a hedging tool can provide an asymmetric risk profile, where for a fee the option buyer can have limited risk while participating in any favourable currency movements during the life of the option contract. They are uniquely suited to solve the hedging dilemmas where markets are volatile or exposures are uncertain.

The first section of this module provides the framework for understanding the unique nature of an option contract. The second section addresses the different terms which define the option contract and the market mechanics. Thirdly, it will cover the components of option premium pricing and the measures of price sensitivity. The last section will cover building derivative hedging strategies using simple put and call options.

THE NATURE OF OPTION CONTRACTS

Option contracts provide a method for corporations with foreign exchange exposures to hedge the risk associated with changes in foreign exchange rates. Option contracts offer protection against exchange rate movements by guaranteeing a rate of exchange for some future period. A corporation importing from Japan will need to exchange their USD for JPY when payment for the Japanese goods is due in three months. If the JPY increases in value in the intervening time, those imports will become more expensive in USD terms. The corporation may want to guarantee the rate at which they will be able to exchange USD for JPY. They can accomplish this with a forward foreign exchange contract as discussed in previous section, or they can enter into an option contract for the same period of time.

An option contract represents a right, but not an obligation, to exchange currencies. Option contracts are often compared to insurance policies; for an established fee which is paid in advance, an option provides risk insurance to the holder. As in the insurance business, this fee is termed the premium. The option writer receives the premium as compensation for taking over the currency risk during the life of the option. There are two types of options:

CALL OPTIONS = THE RIGHT, BUT NOT THE OBLIGATION, TO BUY

PUT OPTIONS = THE RIGHT, BUT NOT THE OBLIGATION, TO SELL

We will adopt the convention of terming a delivery of USD in exchange for another currency as a purchase of that currency. Likewise, the receipt of USD in exchange for the delivery of another currency will represent a sale of that currency. An option to buy a currency and pay USD will, by convention, be termed a call option on the currency. An option to sell a currency and receive USD will be termed a put option. For the sake of

clarity in our discussion, the non-USD will always be the option currency and the USD will be the counter-currency.

There are two parties to an option contract, the buyer of the option and the seller of the option. An option buyer purchases the right to exchange for a period of time at a fixed rate but is not required to do so. An option seller sells the promise to exchange at the fixed rate on demand of the option buyer. Option buyers are also referred to as holders of the contract and are said to have a "long" position in options. Option sellers are referred to as writers or grantors and are said to hold a "short" position in options.

- OPTION BUYERS PURCHASE A RIGHT TO EXCHANGE AT A FIXED RATE
- OPTION SELLERS SELL THEIR OBLIGATION TO EXCHANGE AT A FIXED RATE
- THE PRICE WHICH THE OPTION BUYER PAYS THE OPTION SELLER IS THE PREMIUM

There are potentially two transactions for each option contract. Initially when the option contract is entered into, the option seller gives the right to demand the exchange of currency to the option buyer, who in turn gives the seller the premium fee. The second transaction occurs if the option holder decides to demand the exchange of currencies; exercise the option. After the option is exercised, the option holder and writer are required to exchange currencies at the contracted rate.

RIGHTS AND PERFORMANCE OBLIGATIONS

BUYER'S OBLIGATIONS

The only performance obligation of an option buyer is payment of premium to the seller. After the premium has been paid, an option buyer has the right to exchange currency at a predetermined fixed rate called the strike price. After payment of the option premium, all obligations of performance fall to the option seller.

BUYER'S RIGHTS

The buyer has three choices at contract expiration:

Exercise the option - if the buyer chooses to exchange currencies at the strike price, the buyer informs the seller of the option. After this notice is given, both parties are obligated to exchange currencies at the fixed rate. This process is termed "exercise" and the option becomes a foreign exchange contract.

Allowing the option to expire - If at the time exchange is desired, the market rate is preferential to the strike price, the option holder has no need to exchange at the strike price. The holder is free to exchange at the more advantageous market rate and simply "walk away" from the option contract.

Offsetting the option - If prior to expiration, the option holder no longer has the need or the desire to hold the option contract, the choice may be made to sell an offsetting option. This relieves the holder of the position and the holder receives premium back for the contract.

SELLER'S OBLIGATIONS

An option seller must stand ready to exchange currency at the strike price if the option is exercised. Since option buyers will only exercise when it is to their advantage, the option sellers, being on the other side of the transaction, know that any exercise is to their disadvantage.

SELLER'S RIGHTS

It is the seller's right to receive and hold premium at the outset of the transaction. Since any exercise of the option is to the seller's disadvantage, it is in the seller's interest that exercise does not occur. Just as there are bids and offers in the foreign exchange market, there are also these terms in the options market. Option bids and offers refer to the option contract what premium amount the market maker will buy or sell a particular contract for. There are four distinct stances in relation to the underlying foreign exchange market.

- CALL BUYERS = PURCHASERS OF THE RIGHT TO BUY A CURRENCY; LONG CURRENCY AT THE STRIKE
- CALL SELLERS = SELLERS OF THE RIGHT TO BUY A CURRENCY; SHORT CURRENCY AT THE STRIKE
- PUT BUYERS = PURCHASERS OF THE RIGHT TO SELL A CURRENCY; SHORT CURRENCY AT THE STRIKE
- PUT SELLERS = SELLERS OF THE RIGHT TO SELL A CURRENCY; LONG CURRENCY AT THE STRIKE

HOW OPTIONS AND FORWARD CONTRACTS DIFFER

Like a forward contract, an option contract guarantees its holder a fixed rate of exchange for some future period. Unlike forwards, option contracts grant the holder the choice of whether or not to exchange at the strike price. The option contract carries an explicit upfront cost, which is not a factor for forwards. Following is a comparison of the differing nature of option contracts and forward contracts.

COMPARISON OF RIGHTS AND OBLIGATIONS

WHEN YOU PURCHASE AN OPTION YOU:	***WHEN YOU ENTER INTO A FORWARD CONTRACT YOU:***
HAVE THE OPTION TO EITHER - BUY OR SELL THE CURRENCY	HAVE EITHER BOUGHT OR SOLD CURRENCY FOR FORWARD SETTLEMENT
NEED NOT DELIVERY OR RECEIVE CURRENCY	MUST TAKE DELIVERY OR OFFSET AT THE PREVAILING MARKET RATE
SET THE RATE OF EXCHANGE WHERE YOU CHOOSE	USE THE CURRENT FORWARD RATE
PAY A PREMIUM CHARGE WHEN THE OPTION IS GRANTED AND PAY SETTLEMENT AMOUNT IF EXERCISE	PAY NO PREMIUM. PAY SETTLEMENT AMOUNT AT MATURITY

TERMS OF OPTION CONTRACTS

The conditions which define a given option contract are referred to as the terms of the contract and have direct impact on the option price. There are eight different terms that define a particular option contract.

BUY OR SELL Determines which party is option holder and which is option writer

CURRENCIES The two currencies to be exchanged

EXERCISE AMOUNT The amount of currency to be exchanged

STRIKE PRICE The purchaser of an option generally indicates the strike price desired. Strike prices can be at-the-money (equivalent to the outright forward rate), in-the-money (more advantageous than the market rate), or out-of-the-money (less favourable than the current market rate). The strike price determines the USD amount to be exchanged with the currency exercise amount. To simplify this discussion, all strike prices will be quoted in American terms (USD/currency unit).

PUT OR CALL Those who wish to guarantee a rate at which to buy currency would purchase a call. The purchase of a put would suit a seller of currency. Option sellers would reverse their interest.

EXPIRATION DATE Expiration times as well as dates must be determined. The rights and obligations of the option contract remain in effect until that point in time. After that, the option is worthless.

EXERCISE TERMS The exercise term is the period during the option's life when exercise may occur. There are two standard types, American style and European style exercise terms. American style allows exercise anytime from when the option is granted until it expires. European exercise terms allow for exercise only on the expiration date before the expiration time of the option.

PREMIUM AMOUNT AND DATE The price of the option contract. It is the amount of money that the buyer pays the seller for the right without the obligation to exchange currency at a fixed rate. It may be quoted in US cents per unit of foreign currency, as a percent of the USD exercise amount, or as a total dollar cost. The premium is usually due on the spot date of the currency traded; two business days out for most currencies, one day for CAD.

OPTION PRICING - THE COMPONENTS OF PREMIUM

Premium costs are a crucial factor in determining the effectiveness of foreign currency options as a hedge. The size of the premium is the prime determinant of the break even level for an option hedger. An option with a premium that is more expensive than the expected currency movement will not look attractive in comparison with a forward contract.

The price of an option represents a complex interaction of several considerations. There are two separate components of an option's premium price: intrinsic value and time value. Four main factors have an impact on these two components: the difference between market price and strike price, time to expiration, volatility, and interest rates. In order to determine an estimated value of option premium, it is necessary to isolate the two components of premium value, time value and intrinsic value. The premium quote which is received represents the total of these two separate valuations.

In practice, currency options are most frequently priced using adaptations of the Black-Scholes model, such as the Garmen-Kohlhagen model (1983). Put and call premiums are calculated from the following set of equations:

$$c = e^{-rT} [F_0 N(d_1) - X N(d_2)]$$

$$p = e^{-rT} [X N(-d_2) - F_0 N(-d_1)]$$

where:

$$F_0 = S_0 e^{(r - r_f)T}$$

$$d_1 = \frac{1n\left(\frac{F_0}{X}\right) + \frac{\sigma^2}{2}T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

and:

c	=	call premium
p	=	put premium
S_0	=	spot FX rate, the value of one unit of foreign currency measured in domestic currency
F_0	=	forward FX price
X	=	strike price
T	=	difference in spot and strike date in years
r	=	continuously compounded domestic discount rate for time T
r_f	=	continuously compounded foreign discount rate for time T
σ	=	exchange rate volatility (formula below)
$N(d_1)$	=	the cumulative normal probability distribution function for d_1
$N(d_2)$	=	the cumulative normal probability distribution function for d_2

Some use the following statistical equation to calculate *historical volatility*:

$$\sigma = \sqrt{\left[\frac{1}{(n-1)}\sum_{i=1}^{n} U_i^2 - \frac{1}{n(n-1)}\left(\sum_{i=1}^{n} U_i\right)^2\right]} \times m$$

where:

$$U_i = 1n\left(\frac{S_i}{S_{i-1}}\right)$$

S_i	=	spot rate FX rate on day i
n	=	number of observation
m	=	number of trading days per annum, approximate 252

Continuously compounding rates are interest rates that are expressed as if interest compounds immediately. An interest rate, rm, compounding m times per year, can be easily converted into its continuously compounding equivalent using the following formula:

r = $log_e(1+r_m/m)*m$

TIME VALUE + INTRINSIC VALUE = OPTION PREMIUM

Intrinsic value is simply the difference between the strike price and the market price if the strike price is more advantageous to the holder of the option. With European style options, the strike price is compared to the forward price to determine intrinsic value. If there is no advantage to the option holder, the option will have no intrinsic value, only time value. Time value is the incremental cost of owning the time to decide whether or not to exchange. Time value approaches zero at expiration.

- **INTRINSIC VALUE:** It is dependent on the relationship between the option strike price and the current market price in one of the following ways:
- **AT-THE-MONEY**: An option with a strike price equal to the current market. This can be measured by the spot or forward market rate.
- **OUT-OF-THE-MONEY:** A call option with a strike price above the current market or a put option with a strike price below the current market. There is no intrinsic value in an out of the money option
- **IN-THE-MONEY:** A call option with a strike price below the current market or a put option with a strike price above the current market. These options have intrinsic value.

PRICE

Determining the amount of intrinsic value is the starting point for assessing an option premium. Once intrinsic value has been determined, it can be subtracted from the total premium cost in order to isolate the time value component. Because intrinsic value represents the advantage the option holder would have by exercising, and since the holder has no obligation to exercise an option that is not an improvement over the current market, intrinsic value can never be less than zero.

When market prices are below the strike price, call options will have no intrinsic value. As the market price moves above a call's strike price, the option will gain intrinsic value point for point with the increases in the market price. Put options with a strike price below the market price will have no intrinsic value since there is no advantage to selling the currency at a lower than market price. As the market price moves below the strike price, the intrinsic value of the put option gains a point for each point that the market decreases. When the strike price of an option is equal to the current market price, the option is said to be at-the-money. If an option purchaser does not want to pay intrinsic value at the setting of the strike price, he would choose a value that is at-the-money or out-of-the-money.

FACTORS AFFECTING INTRINSIC VALUE:

USING SPOT OR FORWARD MARKET PRICES

The intrinsic value of European style options is always calculated against the outright forward rate. Intrinsic value always represents the most that would be realized should the option be exercised to the holder's greatest advantage. When a currency sells at a forward discount to USD, a call will have less intrinsic value in the future as the forward discount decreases the market rate in relation to the strike. Likewise, when a currency sells at a forward premium to the dollar, a put will have less intrinsic value in the future as the forward premium moves the market price higher in relation to the strike.

TIME VALUE

The difference between total option premium and the intrinsic value of the option is the **time value** of the option. It is simple to calculate as a derivative value.

TOTAL OPTION PREMIUM - INTRINSIC VALUE = TIME VALUE

Arriving at an estimate of time value to add to intrinsic value is much more complex. Central to understanding the factors which effect time value is an understanding of its theoretical origins. Time value can be thought of as the option writer's cost of hedging the option. It is the risk premium in the option. To the option writer, this risk premium is the highest when the option is at-the-money, because at this point there is the greatest uncertainty over whether the option will expire worthless or have some value at maturity. If the option moves in-the-money, the writer can be surer of exercise and as it moves out-of-the money, no exercise is more certain. In simple terms, the longer the time to expiry the more an option is worth. But as time passes, the option writer can define the risk more accurately, and in the last few days before expiry the time value diminishes or decays rapidly.

Time value is a function of many variables:

- The relationship between strike price and market rate
- The time to maturity
- The interest rate difference between the two currencies
- The volatility of the currency pair

An option writer's risk is that the option will be exercised. The risk of exercise changes as the market price changes relative to the option's strike price. Therefore an option writer desiring to hedge with spot transactions must adjust the hedge as the market changes. These adjustments involve market costs. The time value which the option writer demands reflects an estimate of the future costs of hedging. This is the basis for all option pricing models

VOLATILITY
There is a direct relationship between volatility and time value. As volatility increases, time value increases for both put and call options. This makes sense intuitively. If prices are stagnant, the potential for an out-of-the-money strike to become in-the-money is low. If volatility increases, the potential for the option to be in-the-money at expiration increases. Volatility is the single most important component of time value. Assessing volatility is an important consideration for option buyers or sellers. There are two different methods of assessing volatility levels.

HISTORICAL VOLATILITY
This is sometimes termed actual volatility and measures the component over some past period of time. This measure is a function of the average price of a currency, the daily price change, and the number of observations. These variables, when analyzed as a standard deviation, yield an assessment of volatility over some past period. Such a measure would lead to a good price for time value if volatility remained constant over an option period. Foreign currencies, like other commodities, have less stable volatilities. Relying solely on this measure would lead to considerable inaccuracies in option pricing.

IMPLIED VOLATILITY
In an attempt to improve the predictive ability of historical volatility, various weighting factors have been applied to the standard deviation formula. These are based on the premise that recent experience is a better predictor of the future than is more distant price action. Implied volatility is an alternative to historical volatility. It lets the market decide where volatility will be in the future. The Black/Scholes model was constructed to use volatility to solve for an option's value. Using the model, one can calculate the implied volatility associated with a given option price.

INTEREST RATES
Changes in relative interest rates have an effect on both the intrinsic and time value components of option premium. As foreign interest rates change relative to domestic rates, the intrinsic value of all European style options will be affected. This will in turn affect their time value by increasing or decreasing the distance between the market price and the strike price. Remember, at-the-money options have the greatest time or risk value. An additional effect of interest rate increases is to decrease the premium costs overall. Because an option writer is paid up front and has the ability to invest that premium over the life of the option, an increase of domestic interest rates improves the rate of return on the investment of premium income. This is only a minor consideration in determining time value for currency options.

TIME TO EXPIRATION
Time value decreases as expiration approaches. However, the decay of time value is not linear but tends to accelerate as expiration approaches. A general relationship is that the square root of the number of months remaining for a given option multiplied by the one month time value of the identical option will approximately equal that period's premium. All other things being equal - if a one month option costs $1,000, then a four month option would cost $2,000 and a nine month option would cost $3,000. In any case, the rate of decay of an option's time value accelerates sharply, becoming zero at expiration.

MARKET'S DISTANCE FROM STRIKE
As the underlying market price moves farther from the strike, time value will decrease. The effect is the same whether the option moves further in or out of the money. The probability of exercise either approaches zero or 100%. At-the-money options have the greatest uncertainty of exercise and the highest time value. Deep in or out-of-the money options have the least time value. Time value decreases as intrinsic value increases, which has important implications for option buyers. Although intrinsic value is increasing point for point as an option moves through the strike, time value is simultaneously decreasing. The consequence for option hedgers is that initially options will not gain value as fast as their underlying exposures are losing value.

OPTION TRADING RISKS
The first theoretical option pricing model was developed in 1972 by Fischer Black and Myron Scholes. The original model was concerned with the valuation of equity options and was published in the *Journal of Political Economy*, although it has gone through many modifications. The Black-Scholes model works by using the underlying asset to hedge a call option. In the original model, the asset was equity. As the equity price changes, the amount of the underlying asset required to hedge the option position has to be adjusted. But a financial cost is incurred each time that the hedge is altered. The total cost should be covered exactly by the income from investing the premium. Otherwise, riskless profits will occur, and arbitrage will arise to enforce the equality between income and expense. If the cost of hedging equity with options is less than the income from the premium, then it is worth writing options to collect the premium. On the other hand, if the expense exceeds the income from the option premium, it is worth paying the premium to buy the call option and hedging the long option position by selling the equity. This model has been modified several times to

work more effectively with currency options. The binomial model and the Garman-Kohlhagen version are widely used in pricing systems today.

In an earlier section, we looked at the various components of determining premium or option value that are input into the option pricing model. The mathematical model used to price an option can also be used to compute the sensitivity of the option premium to changes in these input parameters. These sensitivity measures are commonly referred to as the "Greeks" as they are named by letters of the Greek alphabet.

MEASURES OF PRICE SENSITIVITY

DELTA: By determining the relationship between the change in the underlying exchange rate and the change in its option price, a pricing model will implicitly calculate the amount of currency required to hedge the exposure. The delta is sometimes known as the "hedge ratio". An option that is far out-of-the-money will have a delta of zero. One that is deep in-the-money will have a delta that approaches 100% or unity. An at-the-money option has a delta of 50% or .5. If you have written a call option, the amount of the underlying asset that you should hold varies with the market price changes. As the option moves deeper in-the-money, more cash hedge is required to meet the certain call. Delta can also be thought of as the probability of exercise at expiration. An out-of-the money option has a low probability of exercise, but an at-the-money option has a 50% chance of being in-the-money at maturity. Option positions that are paired with the appropriate offsetting cash position are said to be delta neutral or delta hedged.

GAMMA: This is the rate of change of delta. Mathematically, gamma is to delta as acceleration is to speed. Gamma measures how quickly the delta will change with movements of the underlying exchange rate. The higher the gamma, the more often the hedge will need to be adjusted. Assuming there is a financial cost associated with each adjustment, option writers prefer fewer adjustments while option holders, who earn on each change, look to own high gamma positions. Gamma is usually expressed as positive or negative depending on whether the movement is good or bad from the perspective of the party concerned. Long options positions have positive gamma, short positions have negative; the former will gain by delta change, the latter will lose.

The nearer the strike to the market rate the higher the gamma; the nearer the option to maturity, the higher the gamma; the lower the volatility, the higher the gamma. The first two relationships are fairly intuitive. The volatility factor influences gamma in that if there is low volatility with a low probability of rate change, the movement in delta will be more severe if rates do move, the result of which is higher gamma.

VEGA: This is a rate of change in an option's value relative to a change in the volatility factor. A change in volatility can result in a change of premium so Vega measures the sensitivity of an option's price to a one percent change in implied volatility. Vega increases with time, so longer dated options have higher Vega than those with shorter maturities.

THETA: This is the measurement of the sensitivity of an option's value to the elapse of time. Theta is usually measured as a loss of premium value over one day, given that no other factors change. An option with a theta of .025% would lose USD 250.00 over the next day for every USD 1,000,000 of face value. Theta is highest, as is the time value component, when an option is at-the-money. It is also non-linear, losing value rapidly as the option nears expiration. Theta is also referred to as positive or negative depending on whether you are an option writer (positive) or an option holder (negative)

RHO: Is the sensitivity of an option's value to change in interest rates. Although not considered significant compared to the other option risks, RHO is usually measured as the change in premium due to a 1% change in the interest rate differentials.

LAMBDA: Another obscure measurement of sensitivity, lambda indicates the leverage of an option, usually measured against a 1% movement in the exchange rate. Low delta and short dated options carry the highest lambda. The premium of an option with a 25 lambda will increase 25% for a 1% move in the underlying rate.
All of these risks are derived from the option pricing model, but are only models of reality. To use any model effectively, it is important to understand the simplifying assumptions. One key assumption is that the spot exchange rate moves in a random fashion around a trend line. It is assumed that a scatter of possible outcomes will follow a log-normal representation, which rarely happens in reality. This is called dispersion and is equal to volatility. A higher volatility implies a greater dispersion of prices on expiry and therefore a greater possibility of profitable exercise by the option holder.

ANALYZING AN OPTION'S HEDGE CHARACTERISTICS

The first step in analyzing an option's hedge characteristics knows how to read a profit and loss graph. A profit and loss graph provides the picture of how the profit and loss of a foreign exchange position changes as the exchange rate varies. These graphs are represented in a standard X, Y format.

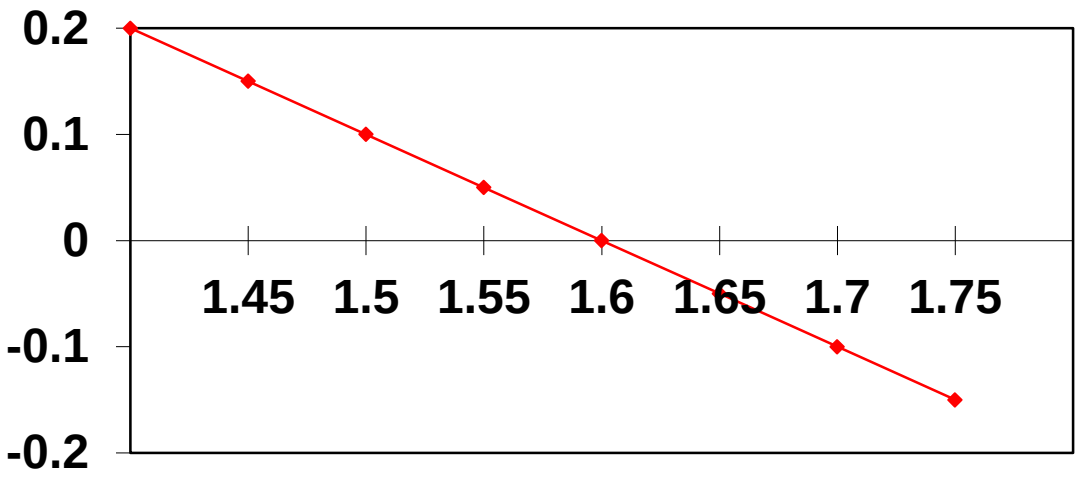
An X, Y format tracks the relationship between two variables. The vertical axis represents a range of values for one of the two variables. The horizontal or X axis represents a range of values for the other variable. The curve, or line, which appears between the two axes, represents the relationship between the two variables. This allows the reader of the graph to determine the value of the second variable once the value of the first is known.

The two variables of interest to those with foreign exchange exposures are the relationship between profit or loss and exchange rate movements. These generally measure profit or loss on the vertical or Y axis. Exchange rates are shown increasing from left to right on the horizontal or X axis. This means moving from left to right represents appreciation of the currency in USD terms.

Often, a second horizontal line is drawn directly through the midpoint of the Y axis. This represents the break-even or zero profit/loss line. When the points on the curve fall above this line, it represents a profit. When the points on the curve fall below the line, the position is showing a loss.

GRAPH OF A SHORT OUTRIGHT POSITION

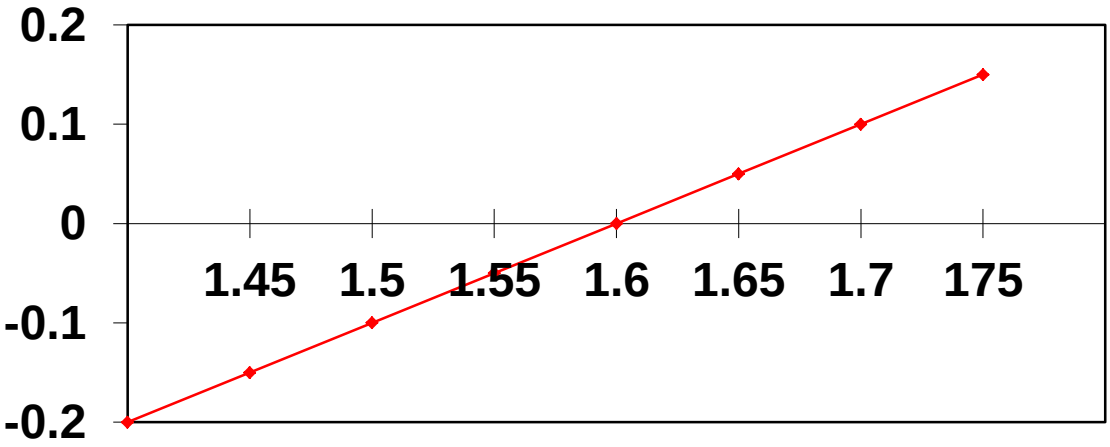
As an introduction to reading the profit and loss graphs examine the profile for a familiar position. Below is the graph for a short currency position. To be short a currency means that one has to sell the currency. If the price increases, a loss results and as the price decreases, there is increasing profit. The downward sloping line represents this relationship.



The preceding graph could represent the situation of an importer who was required to pay GBP at some future date. At the time that the contract was signed, the rate for GBP/USD was 1.6000. The importer figured the total USD cost of the imports using this rate. If the rate is 1.5500 when payment on the contract is required, the importer will pay .0500 points USD less per GBP. This represents additional profit to the importer. If the rate is 1.6500 when the bill is due, the importer must pay .0500 points USD more per GBP than the original estimated cost. This represents a loss to the importer. If the rate is 1.60 at the time of payment, the importer will pay exactly what was estimated. This is the break even rate.

GRAPH OF A LONG CURRENCY POSITION

A long currency position has a profit and loss graph which is a mirror image of a short currency position. To be long a currency means to buy the currency. If one owns the currency and its price increases, one experiences a gain. Below is the profit and loss graph for a long currency position. The upward sloping line indicates that the position gains value as the price of currency increases in terms of the USD.



The same scenario as the previous example, except for an exporter with GBP receivables, would be depicted by this graph.

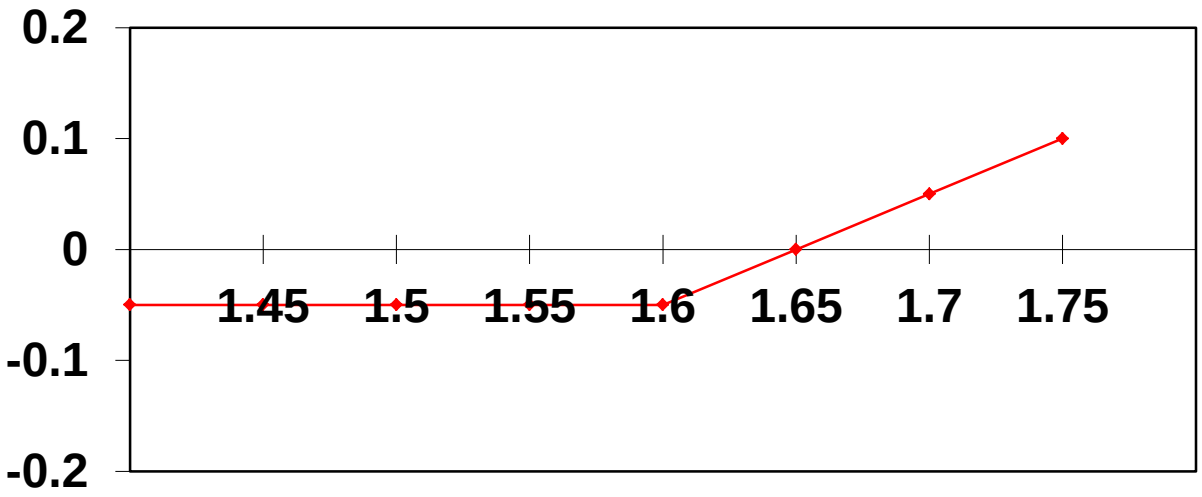
DERIVING GRAPHS FOR OPTION POSITIONS

Like long and short currency positions, option positions can be depicted using a profit and loss graph. These graphs are particularly useful when applied to currency options because here profit and loss do not have a constant relationship with the market price. This is what gives options an asymmetrical risk profile which is best understood graphically. In addition, these graphs are very useful to option strategists because they provide a means of tracking the wide variety of possible market positions. As discussed in the first section, there are four basic option positions: long a call option, short a call option, long a put option, and short a put option. Each of these four positions has a unique profit and loss profile.

GRAPH FOR LONG CALL OPTION POSITION

A call option buyer has the right, but not the obligation, to buy currency at a contractually determined price for which the buyer pays a flat premium fee. Assuming that at expiration the option may be exercised or allowed to expire, the profit or loss of the position can be determined for each underlying market price. Calls will not be exercised if the strike price is less than the market price. The loss on the position is equal to the cost of premium (measured in USD points per currency unit on the graphs). Call holders will exercise if the strike price is greater than the market price. The gain which will be captured will be the intrinsic value of the option; however, to receive a true picture of profit, the premium price must be deducted from the proceeds. A call holder will have a net profit if the market price less the strike price exceeds the premium price. A call holder's break-even price is equivalent to the strike price plus the premium.

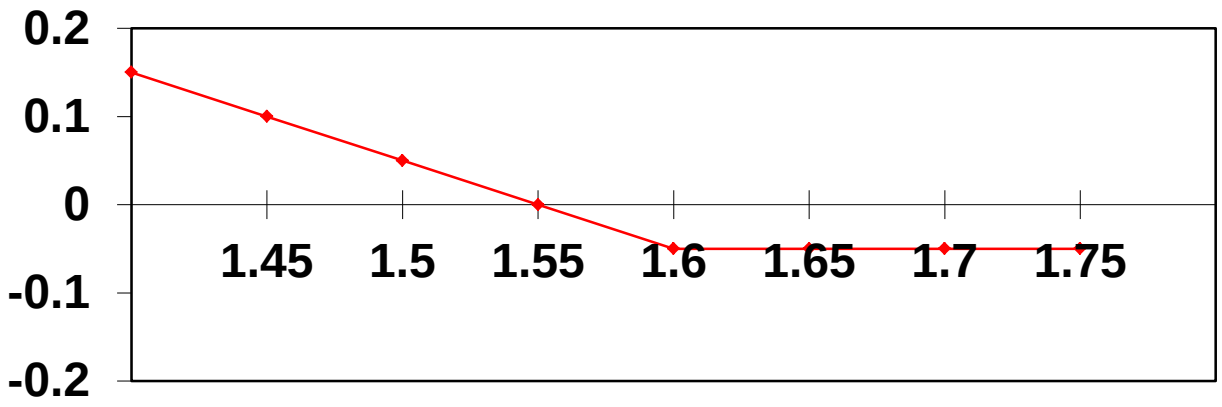
The next graph depicts the profit and loss profile of a holder of a GBP call with a strike price of 1.6000 (the premium price was 500 points)



- If at expiration the GBP is trading at 1.6000, the holder will have no reason to exercise and the loss is limited to the premium or .05.
- If at expiration the market price for GBP is 1.5500, the holder will have recovered the premium by not exercising the call option and trading 500 points better than the strike price. If the GBP is trading lower at this time then the profit will be equal to the market price less the premium paid.
- If at expiration the GBP market price is 1.6500, the option will be exercised at 1.6000 and once again the loss will be limited to the premium paid.

GRAPH FOR A LONG PUT POSITION

A put option purchaser has the right, but not the obligation, to sell a currency at a given strike price for which a flat premium fee is paid. This graph is for a put option struck at 1.6000 with a premium of .05. The graph will be a mirror image of that of a call holder since a put holder experiences gains as a currency depreciates. Assuming a currency can't have a negative value; these gains are not unlimited like a call holder's gains could be, in theory. The loss on a put option will be limited to the cost of the premium. The profit is calculated by subtracting the market price from the strike price and then subtracting the premium. Again the position will break even when the difference between the strike price and the market price is equal to the premium.



- If at expiration the GBP is trading at 1.6000, the holder will have no reason to exercise and the loss is limited to the premium paid.
- If at expiration the GBP is trading at 1.6500, the holder will have recovered the premium by not exercising the call option and trading 500 points better than the strike price. If the GBP is trading higher at this time then the profit will be equal to the market price less the premium paid.
- If at expiration the GBP is trading at 1.5500, the option will be exercised at 1.6000 and once again the loss will be limited to the premium paid.

HEDGING OPTIONS — DELTA HEDGING
What can a bank do to hedge the risk when it sells an option?

The risk the bank has as a seller is that if the exchange rate moves such that the option becomes more valuable — if it is unhedged, the bank could potentially incur limitless losses.

Suppose a trader sells a call option on the Euro at 1.3500 and the exchange rate goes to 1.3800. Under these circumstances, it is highly likely that the buyer will exercise his right to buy Euro at 1.3800. In other words, it is highly likely that the trader could incur a 300-point loss. Since a bank selling an option knows what the option will be valued at if the exchange rate moves in a certain direction, it is able to either buy or sell the currency in the spot market to hedge the risk. This process is known as ‘delta hedging’. Delta hedging sold options will
inevitably incur losses. These losses are the debit side of selling an option. The credit side is that the seller receives an option premium from the buyer. The objective of a bank that sells an option is to lose less money in hedging than it receives as premium from the buyer. This will happen if the currency exhibits less volatility during the life of the option than was priced into the option. If the currency exhibits more volatility, then this will lead to losses from hedging that are larger than the amount received as the option premium.

It follows that a bank will sell and hedge an option when it believes that the future volatility of the currency will be less than the volatility entered into the Black-Scholes formula at the time of the sale. A bank will buy and hedge an option when it believes that the future volatility of the currency will be greater than the volatility input into the Black-Scholes formula at the time of the purchase.

EXOTIC OPTIONS

Digital options: A ‘digital option’ has a fixed payout regardless of how far it is in-the-money. Digital options are also known as ‘binary options’. An ‘at-expiry’ digital option has its payout determined by the market price at its expiry. A ‘one-touch’ digital option pays out if the market price reaches the strike price during the life of the option. The payout for a one-touch option can occur at either the time of touching or at expiry, depending on the terms of the contract. Digital options have a number of powerful applications for people managing currency exposures.

Pay-later options: A ‘pay-later option’ is one for which the premium is paid only if the option expires in-the-money. These are also known as ‘contingent premium options’. If paid, the premium must be larger than the up-front premium of the corresponding standard option.

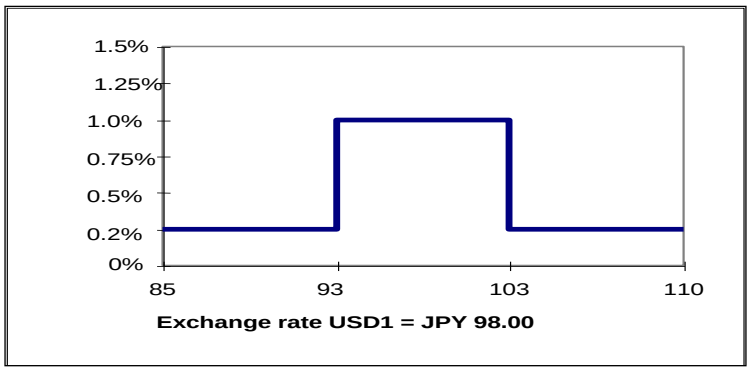
Currency-linked notes: A ‘currency-linked note’ is an instrument for which the yield is a function of the exchange rate. Many structures are possible. A popular one gives the investor a better-than-market yield provided the exchange rate remains within a specified range, but a lower-than-market yield if it moves outside of that range.

If the six-month USD interest rate is 0.5% per annum when spot USD/JPY is 98.00, an investor might be able to purchase a currency-linked note for which the yield will be 1.0% per annum, provided the USD remains within a range of 93.00 to 103.00 for the entire six months, but only 0.2% per annum if at any time the spot rate touches or moves above 103.00 or below 93.00.

The currency-linked note would normally be packaged by the bank as a single product. To construct it, the bank would sell two one-touch digitals. The future value of the premium received would be sufficient to lift the yield to 1.0% per annum provided neither level is touched. The payout would be such that the yield is reduced to 0.2% per annum if either digital option is exercised.

This sort of product appeals to many investors because their capital is guaranteed, and they are assured a minimum acceptable return, with the possibility of a yield that is much higher than otherwise available. The investor is effectively betting that the exchange rate will be less volatile than is being priced into the options.

Figure 2: Currency-linked note: effective yield % pa



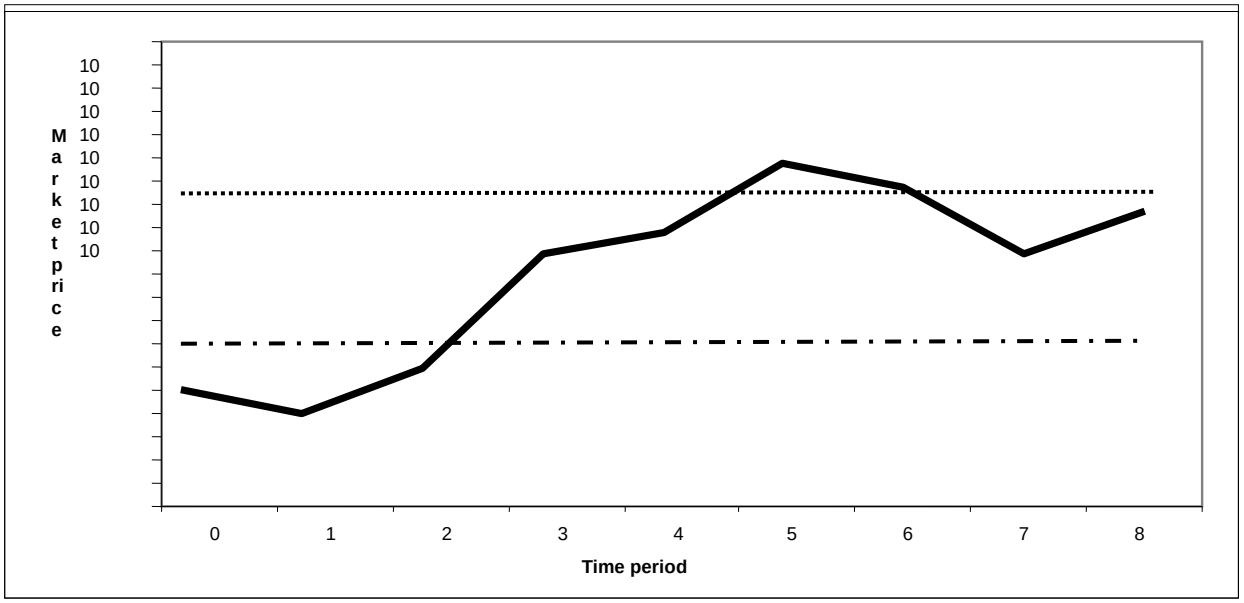
Barrier options: 'Path-dependent options' are those whose payout depends on the path the market price follows through the life of the option.

Standard calls and puts, as well as at-expiry digitals, are not path-dependent because their payout depends only on where the market price is at expiry compared with the strike price.

One-touch digital options are one example of path-dependent options. The most common group of path-dependent options are known as barrier options. Other examples of path-dependent options include average rate, or average strike, options and look-back options.

'Barrier options' are options that can be knocked-out or only kick-in if the market price reaches a specified level. There are variations where the barrier applies for only a specified part of the life of the option, and these are known as 'window' options. There are also options with multiple barriers. 'Knock-out options' have a zero pay-out if the barrier level is reached, even if the market price at expiry is better than the strike price. 'Knock-in options' have a zero pay-out unless the option expires in-the-money (i.e. the market price at expiry is better than the strike price and at sometime during the life of the option the market price has reached the barrier level).

Figure 3 Knock-out USD call/JPY put: Strike = 96.0, knock-out = 102.5



The option illustrated in Figure 3 above is an 8-month USD call/JPY put with strike price at 96.00, but which knocks-out at 102.50. The solid line shows one of the many possible paths which the market price could follow during the life of the option. At inception the spot rate was 94.00. At expiry it was 102.0. This particular option would have been knocked-out during the fifth month when the spot rate went through 102.50. So, even though the spot rate at expiry was well above the 96.00 strike price, the payout would be zero.

If, instead, the option had been a knock-in at 102.50, the pay-out would have been:

Payout	=	Expiry price – strike price
	=	102.50 – 96.00
	=	JPY 6.50

NOTES