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Foreign Exchange Market: An Introduction

Prof. Dr AP Faure

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AP Faure

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Foreign Exchange Market: An Introduction
1st edition
© 2013 Quoin Institute (Pty) Limited & bookboon.com
ISBN 978-87-403-0590-6

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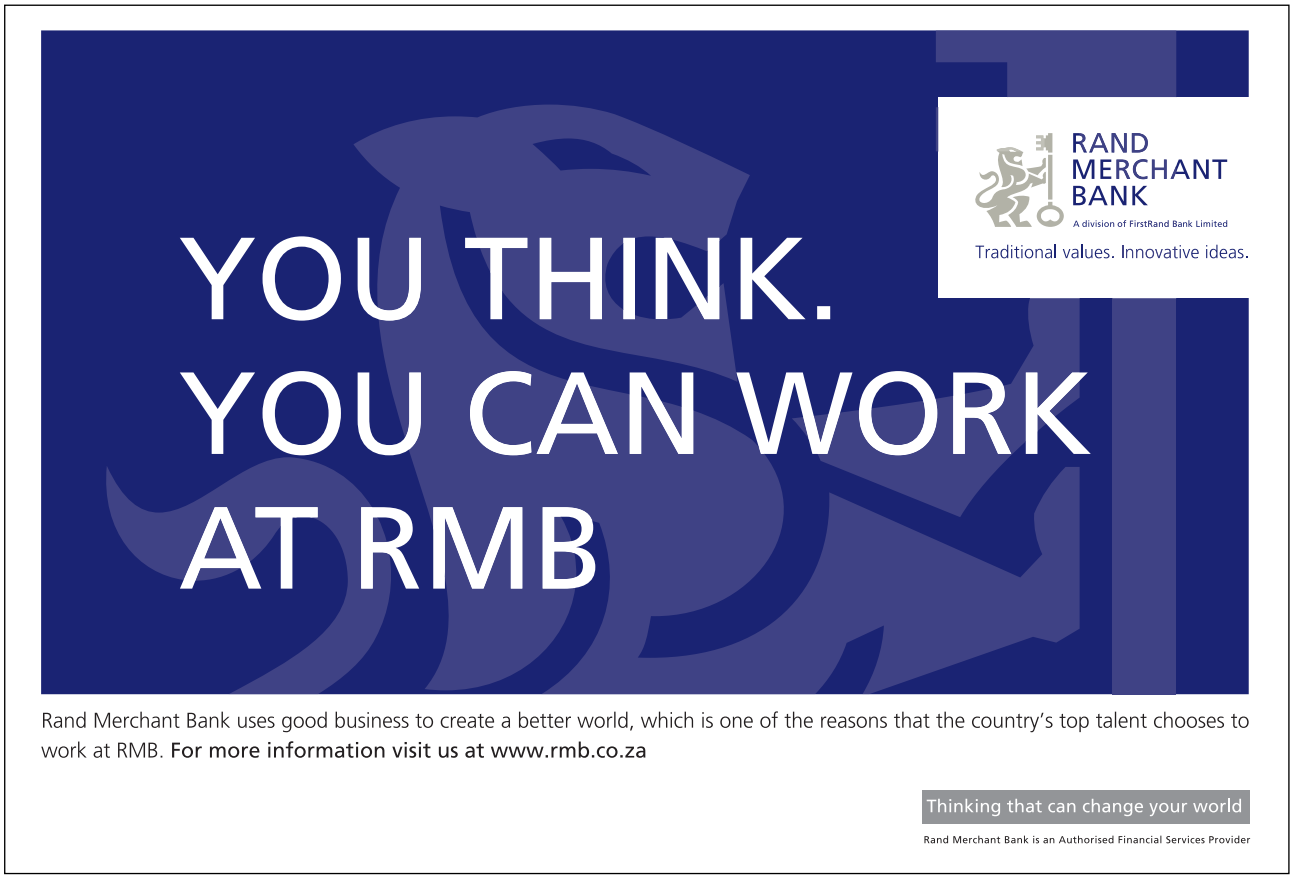

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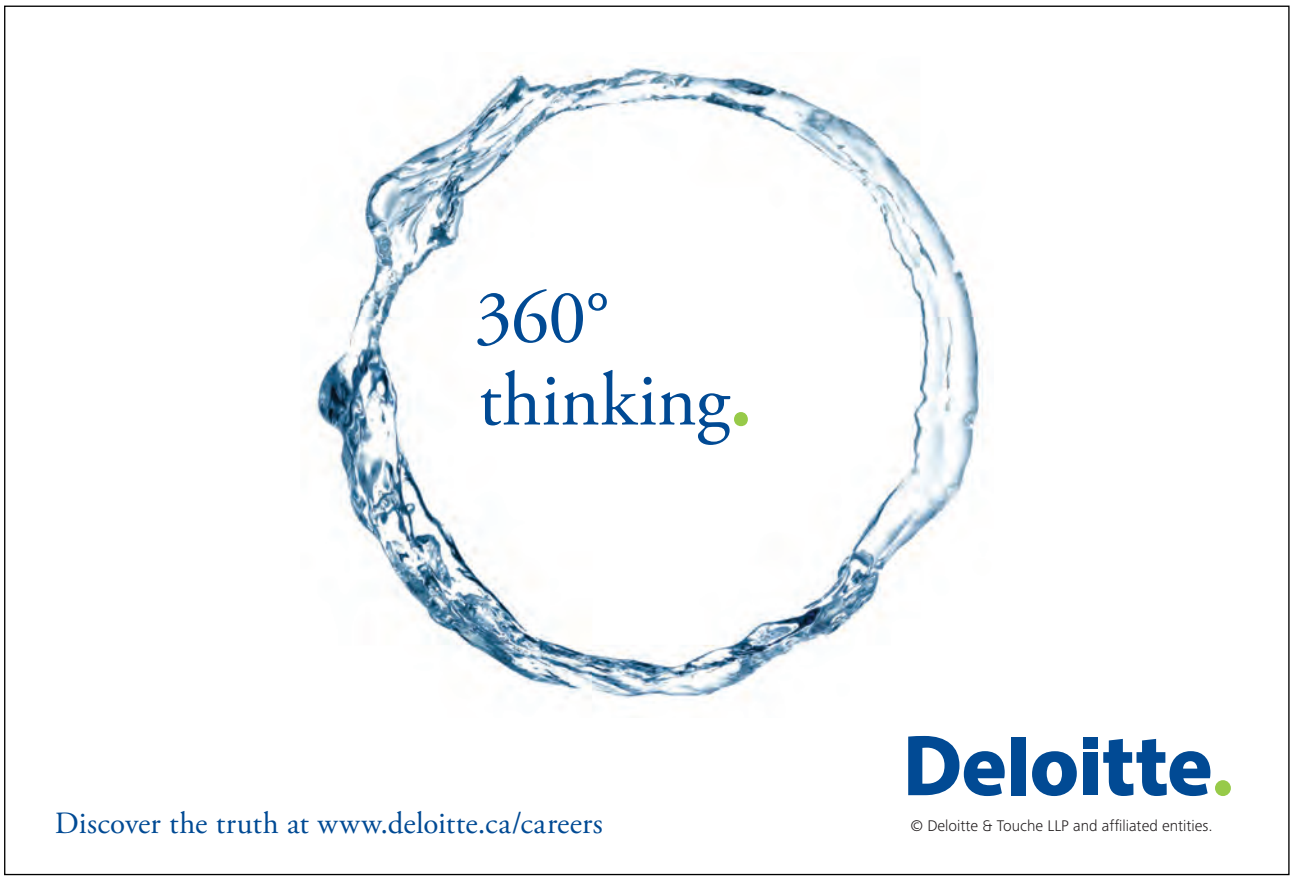

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1 Essence

1.1 Learning objectives

After studying this text the learner should / should be able to:

- Describe the structural organisation of the spot financial markets.
- Describe the essence of the foreign exchange market.
- Explain the basis of the forex market: the exchange of deposits.
- Explain the basic concepts of the forex market: what an exchange rate is, rate quotation convention, two-way prices, spreads, cross rates, etc.
- Describe forex risk.
- Appreciate the importance of exchange rates.

1.2 The foreign exchange market in a nutshell

All the financial markets are depicted in Figure 1. We hasten to add that the foreign exchange market (from now on called forex market), strictly speaking, is not a financial market, because lending and borrowing does not take place in this market. However, since residents (ignoring exchange controls – that exist is some countries – for a moment) are able to borrow or lend offshore, or foreigners are able to lend to or borrow from local institutions, the forex market (which allows these transactions to take place) has a domestic and foreign lending or borrowing dimension, and can be viewed as being closely allied to the domestic financial market. Essentially the forex market is a conduit – as far as investment in financial markets is concerned.

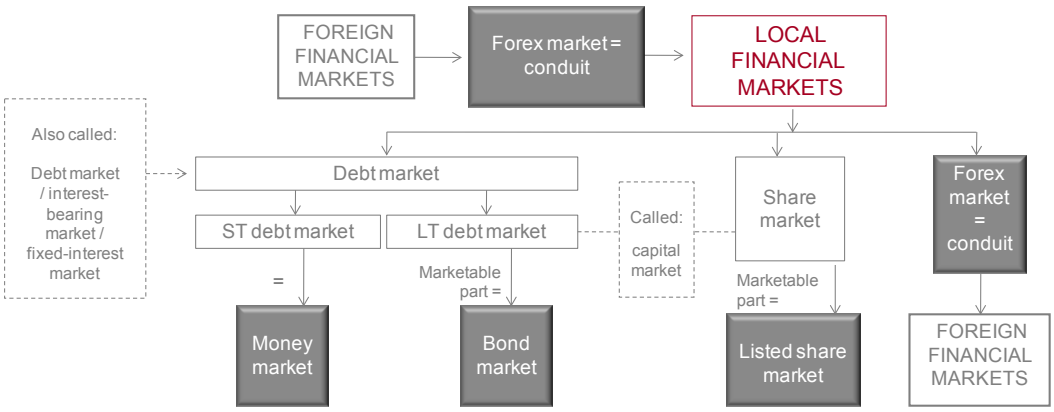

Figure 1: financial markets

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The participants in the forex market are wide-ranging:

- Authorised dealer banks.
- Foreign exchange brokers.
- Foreign banks.
- Central bank.
- Government.
- Retail clients (household sector).
- Non-bank authorised dealers.
- Corporate sector.
- Arbitrageurs.
- Speculators.

We will discuss them in some detail later. As far as the flow of funds (demand for and supply of forex) is concerned, the perspective changes to that indicated in Table 1.

Demand for forex	Supply of forex	BoP account
Importers	Exporters	Trade account
Foreign services used: transport, travel, etc.	Domestic services used: transport, travel, etc.	Services account
Outward payments: interest, dividends, etc.	Inward payments: Interest, dividends, etc.	Income account
Outward investment	Inward investment	Capital account
Foreign borrowing locally	Domestic borrowing offshore	Capital account
Bank net purchase	Bank net sale	Forex reserves

TABLE 1: Demand For And Supply Of Forex

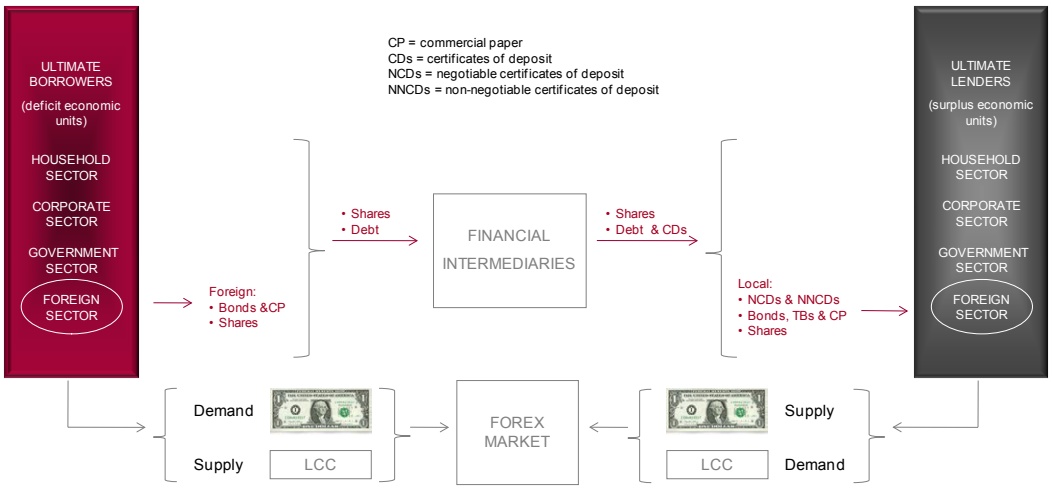

Figure 2: financial system & foreign sector

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These are the categories of the supply of and the demand for forex. They make up the Balance of Payments (BoP) and data on each account are readily available. The outcome of these sources of demand and supply is the exchange rate against the vehicle currency: the USD.

The dominant sources in most countries are imports and exports and capital flows, and in the case of the latter inward investment is significant. Figure 2 depicts the domestic financial system, and indicates the foreign sector as a lender and a borrower. As a borrower (issuer of foreign securities locally), it is small. However, as a lender (supplier of forex), it is a significant player in many countries: it can be a significant buyer of portfolio assets (local shares, bonds and certificates of deposit). It is therefore also potentially a destabilising force in the forex market.

What is forex (or forex reserves)? It is the holding of (or investment in) by a local citizen / institution:

- Foreign cash (e.g. USD notes and coins).
- Deposits in foreign banks.
- Foreign financial securities (e.g. USD treasury bills).

A visit to the local Bureau de Change to buy 200 USD 100 notes (= USD 20 000), for which LCC[1] 131 000 is passed to the teller, is a forex transaction (at an assumed exchange rate of USD/LCC 6.55). This transaction type (the motivation for which is a trip to the US), which we see in action at Bureaux de Change, is a miniscule part of the foreign exchange market. This is the *retail* forex market.

As we have seen, the forex market is dominated by capital flows (in and out) and receipts and payments for exports and imports. This part of the forex market is not visible as the transactions occur over bank accounts. It is the *wholesale* market and this is where exchange rates are determined, i.e. forex market *price-making* takes place in this market. The prices (exchange rates) determined in the *wholesale* market are used (= *price-taking*) in the retail forex market.

The forex market is the mechanisms / conventions for the exchange of one currency for another, for example LCC for USD. The banks are dominant in and "make" this market. It is appropriate for banks to *make* this market because bank deposits are exchanged in the first instance (in the second instance the purchase of a foreign investment is made, for example). The banks *make* this market in that they are prepared at all times to quote buying (bid) and selling (offer) exchange rates.

It will be apparent that in order for a forex market to function there needs to be a demand for and a supply of forex. *Demand* is the demand for, say, USD, the counterpart of which, say, is the *supply* of LCC. This cannot be satisfied without a *supply* of forex (USD), the counterpart of which is a *demand* for LCC. The forex market brings these *demanders* and *suppliers* together.

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Currencies are either:

- *Floating:* if they are free to respond to supply and demand.
- *Managed floating:* if the central bank intervenes in the market by making purchases / sales of forex in order to keep the exchange rate within a specified band (i.e. local currency in terms of another currency – usually the USD).
- *Pegged:* if the exchange rate between the local currency and a specified foreign currency (usually the USD) is fixed by decree.

1.3 Organisational structure of the forex market

Financial market jargon can sometimes be somewhat confusing. Figure 3 depicts the organisation of the forex market and is designed to ease understanding of various terms that will be used in, and to serve as an introduction to, the texts that follow this one.

The terms spot and derivative markets also apply to the forex market, and the terms essentially apply to *settlement dates* (see Figure 4). A spot transaction is a deal done now (at T+0) for settlement on a date established internationally by convention / agreement, which is T+2. The forex market also has a substantial *derivatives market*, the main products of which are forward exchange contracts (outright forwards, forex swaps, forward-forwards, etc), currency swaps, futures and options.

The *proper* financial markets (i.e. the debt and share markets) have the market forms *primary* and *secondary markets*. Only *primary market* applies to the forex market; participants purchase or sell forex and they do an opposite deal if they wish to reverse the initial transaction (as in the derivative markets).

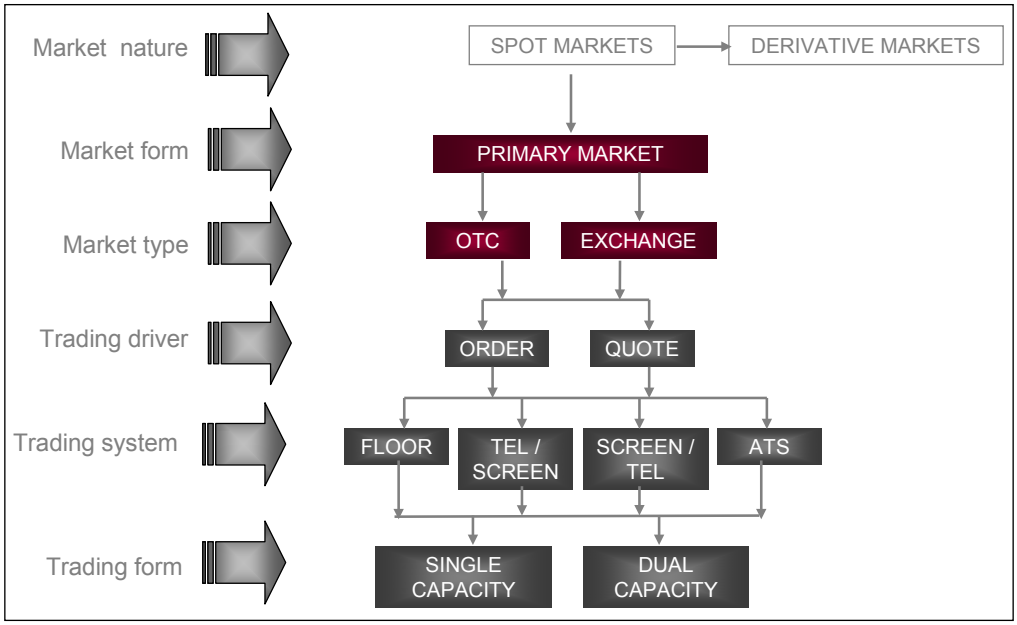

Figure 3: organisational structure of forex market

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Market type denotes *OTC* (over-the-counter) or *exchange* (= formalised market). The spot forex market is OTC, while the forex derivative markets fall into both camps: forward, swap, and some options markets are OTC, while the futures and options on futures markets are formalised (this applies internationally).

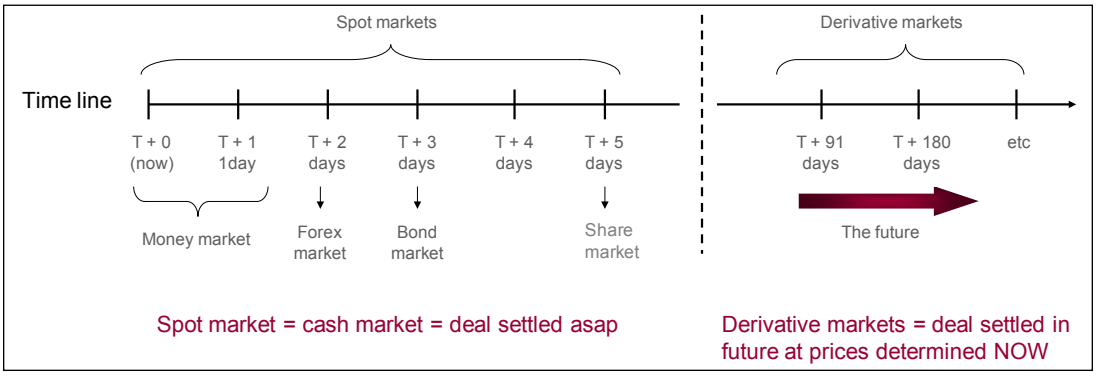

Figure 4: spot & forward settlement (derivative markets)

Both the *trading drivers* "order" and "quote" apply to the forex market. The forex market is the domain of the substantial banks, and they trade as *market makers.* This means that they *quote* buying (bid) and selling (offer) prices simultaneously to clients. Market convention dictates that the clients are obliged to disclose the size of the deal, but not whether they are buyers of sellers. It is up to clients to find the best quotes (exchange rates) by "shopping around". The retail equivalent of the quote-driven OTC market is the prices quoted by the Bureaux de Change.

Order trading in the forex market takes place in a specialised wholesale segment of the market: the domain of the forex brokers. They trade between the forex market makers, i.e. the banks place orders with the brokers and they communicate these (usually via "squawk boxes") to the other market makers. There are two classes of brokers: the *name-give-up brokers* (the smaller ones), where settlement takes place between the principals and not between them and the brokers, and the *principal brokers* (the larger capital-strong ones) where settlement takes place with the broker. It should be noted that although the word *principal* is used, these brokers *do not act as principals* in the sense that they deal for own account.

The *trading system* of the forex market is *telephone-screen*. Prices are communicated on telecommunications systems such as Reuters, but these are regarded as indication rates. Deals are accomplished by participants telephoning the banks and obtaining buy/sell (bid/offer) quotes from them; the banks always quote these two-way prices / rates, unless a client asks for just "one side". As noted, it is accepted practice that the banks quote two-way prices to clients based on a disclosed volume of business, but the client has the right to deal on either side of the quote.

While the clients of the banks get quotes from them under the *telephone-screen* trading system, the banks themselves deal internationally on an ATS system.

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The forex brokers deal in *single capacity* (order only), while the banks act as market makers (quote) as we have mentioned. However, there are times when the banks accept specific orders (usually from smaller clients); thus they deal in *dual capacity.*

The vast majority of deals take place between the banks, and there are many hundreds of banks that actively trade (act as principals) forex in the spot and forward markets; thus to a large degree the forex market is an interbank market. The banks quote rates for a given currency (their home currency) against the USD and also other currencies. By the latter is meant that certain banks in certain countries / markets also quote third currencies against the USD (this is explained in more detail below).

The banks enter into formal agreements with one another, by their signatures on the International Foreign Exchange Master Agreement, before trading with one another. This agreement spells out details such as deal size, delivery, netting, and credit limit.[2]

Turnover in the foreign exchange markets worldwide is substantial. The countries that are most actively involved in forex dealing are the UK, the US, Japan, Singapore, Germany, France, Australia, Canada, and the Netherlands.[3]

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The role of the forex brokers is also substantial. In many countries the market share of the brokers is over 30%.[4] The brokers merely communicate deals / quotes available and, given their market penetration, provide a window into the market. They also offer anonymity to the principals (the banks), meaning that the large deals of banks (which could possibly affect prices) are not communicated to the rest of the market. In the market making forex market reciprocity in dealing is "expected"; the forex brokers preclude such expectations from arising.

1.4 Monetary unit

The currency of each country is the *monetary unit* of that country.[5] In most countries the monetary unit is established under the statute that governs the operations of the central bank. For example, in South Africa this is the South African Reserve Bank Act 90 of 1989. Section 15 of the Act ("Monetary unit") provides:

> *"…the monetary unit of the Republic shall be the rand (abbreviated as R), and the cent (abbreviated as c), which is one hundredth part of the rand."*

Note that the currency code of the rand is ZAR and that this is not set down in law. It is an international convention.

Almost all countries of the world trade amongst one another and many make investments in one another, and this involves the reciprocal exchange of different *currencies*. The *currency* of a country has two parts:

- The *legal tender* of that country, i.e. its notes and coins (which are usually issued solely by the central bank).[6]
- Any investment that is denominated in the monetary unit of that country; in the forex market this is a bank deposit (in the first instance – see below).

The term *foreign currency* is synonymous with the term *foreign exchange*, and means the holding of the currency of countries other the currency of the home country.

1.5 Foreign exchange and bank deposits

In the *forex market* financial instruments such as foreign treasury bills and government bonds are not bought and sold. These instruments are traded in the *debt markets*.

It is important to understand that forex transactions are effected in *bank deposits*. For example, when a Local Country (LC) exporter exports goods to the value of LCC100 million to the US, the importer will pay the exporter not in treasury bills, but in a bank deposit. The US importer will instruct its banker to credit the US bank account of the Local Country exporter. The following T-diagrams should make this clear (assumption: USD/LCC 10.0):

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LOCAL COUNTRY EXPORTER			
Assets (LCC)		Liabilities (LCC)	
Goods (exported) US bank deposit	- 100 + 100		
Assets (USD)		Liabilities (USD)	
Goods (exported) US bank deposit	- 10 + 10		

US IMPORTER (USD MILLIONS)			
Assets		Liabilities	
Goods (imported) US bank deposit	+ 10 - 10		

US BANKING SYSTEM (USD MILLIONS)			
Assets		Liabilities	
		Deposits – US importer Deposits – LC exporter	-10 +10

The Local Country exporter has earned USD10 million in *foreign exchange*, i.e. a bank deposit with a foreign bank in USD. The exporter now has to make a decision on what to do with the USD. Assuming s/he is an astute student of economics, and particularly in exchange and interest rates, and believes that the LCC is about to depreciate against the USD, and that US interest rates are about to fall, s/he will most likely decide to invest the USD in US treasury bills or bonds (we assume bills here). The treasury bills are purchased from a US bank.

LOCAL COUNTRY EXPORTER			
Assets (LCC)		Liabilities (LCC)	
US treasury bills US bank deposit	+ 100 - 100		
Assets (USD)		Liabilities (USD)	
US treasury bills US bank deposit	+ 10 - 10		

The Local Country exporter now has an investment of USD 10 million. Is this foreign exchange? It is. The purchase of the treasury bills took place in the US money market, but the treasury bills are immediately convertible back into a bank deposit, which can then be conveniently sold (exchanged) for some other investment or the purchase of a Local Country bank deposit (i.e. converted to LCC).

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US BANKING SYSTEM (USD MILLIONS)			
Assets		Liabilities	
Treasury bills	-10	Deposits – LC exporter	-10

If the exporter does not wish to speculate on the currency value and interest rates, s/he will sell the USD bank deposit for a local bank deposit in the forex market. In this case the exporter's balance sheet changes as shown below:

LOCAL COUNTRY EXPORTER (LCC MILLIONS)			
Assets		Liabilities	
Goods LC bank deposit	- 100 + 100		

In the case of a simple currency speculation, a number of steps are involved. The first step is to create a deposit in the local currency, in order to pay for the foreign currency. This is done by selling a local security and placing the money on deposit, or borrowing the money and placing the money on deposit.

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The second step is the "selling" of the local deposit in exchange for a foreign deposit. The third step is the purchase of a foreign security (as in the example given above). The fourth step is the selling of the security and the placing of the money on deposit with a bank in the relevant foreign country. The next step is the selling of the deposit in the foreign exchange market for a local deposit. The next step in the case of a borrower is the repayment of the borrowing incurred for the speculative position. Excluding the latter, the steps may be depicted as in Figure 5.

Figure 5: steps in a forex transaction

1.6 International spot rate quotation conventions

A spot exchange rate is the *price of one currency expressed in terms of another currency*. There are two ways in which exchange rates are expressed:

- Domestic currency per unit of the foreign currency; USD/LCC 7.34 / 7.35 is an example.
- Foreign currency per unit of local currency; LCC/USD 0.13624 / 0.13605 is an example.

An explanation follows:

- The three letters in USD and LCC are *currency codes* agreed internationally by ISO[7]. In this example USD refers to the US dollar, and LCC refers to the currency of Local Country. Each currency has a unique code. Other examples are JPY = Japanese yen; CAD = Canadian dollar; AUD = Australian dollar; EUR = euro, common to the members of the European Currency Union; NZD = New Zealand dollar.
- These currency codes are also used in telecommunications systems such as SWIFT[8] and settlement systems.
- The currency on the left of the slash is referred to as the *base currency*, and it is equal to *one unit* of the relevant currency: one USD in the case of the USD/LCC 7.34 / 7.35 quotation. However, the "1" is not written; it is accepted to be 1.
- The currency on the right of the slash is called the *variable currency*.[9]
- The numbers 7.34 / 7.35 mean that one USD is bought for LCC 7.34 and sold for LCC 7.35, for a profit of 0.01 LCC (one Local Country cent) per one USD. The numbers represent a quotation by a bank, i.e. a two-way price. To this we shall return.

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It is convention internationally to quote the USD as the base currency and the other as the variable currency, as we did above in the case of the LCC. However, this is not the only way in which exchange rates are quoted; they are also quoted where the USD is the variable currency and the other the base currency. An example is GBP/USD 1.655 (we ignore the double quotation for the moment) meaning that one GBP is bought for USD 1.655.

In this regard the terms *direct quotation* and *indirect quotation*, and *European* and *American quotation* apply. Much of the literature on foreign exchange markets is confusing in this respect. However, the majority of authors use the following:

- A quotation USD/LCC 7.45, i.e. variable number of units of currency per 1 USD, is called an *indirect* and *European* quotation against the USD.
- A quotation GBP/USD 1.655, i.e. variable number of USD per relevant currency is called a *direct* and *American* quotation against the USD.

The majority of currencies (about 185) are quoted against the USD according to the *indirect (European)* quotation method, as in the case of the LCC. However, the exceptions are (which means that these are *direct (American)* quotations):

- UK pound sterling (GBP) (example: GBP/USD 1.655)
- Republic of Ireland Irish punt (IEP) (example: IEP/USD 1.625)
- New Zealand dollar (NZD) (example: NZD/USD 0.525)
- Australian dollar (AUD) (example: AUD/USD 0.435
- Members of ECU (EUR) (example: EUR/USD 1.125).

Exchange rates may be inverted. This is called a *reciprocal quotation*, which is defined as the *reciprocal of the quotation method usually employed*. For example, the *normal* USD/LCC 7.45 quotation may be inverted to LCC/USD 0.13423 (1 / 7.45). This quotation would be called a *direct (American)* quotation. Similarly, the *normal* GBP/USD 1.655 quotation may be inverted to USD / 0.60423 (1 / 1.655), in which case it is called an *indirect (European)* quotation.

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1.7 Two-way spot prices

Earlier we mentioned that exchange rates / prices are quoted as two-way prices. Examples are shown in Table 2 (the numbers are arbitrary).

Country	Closing mid-point	Foreign currency units per USD	
		Bid	Offer
Local Country (LCC)	7.3450	7.3400	7.3500
Canada (CAD)	1.8955	1.8950	1.8960
Japan (JPY)	110.93505	110.9255	110.9355
Switzerland (CHF)	1.4958	1.4953	1.4963

Table 2: Spot exchange rates against the USD

The exchange rates are number of units of currency per one unit of the USD (the base currency). The closing mid-point is the mid-point between the buying and selling rate. In the case of the USD/LCC it is 7.345 [(7.34 + 7.35) / 2]. This rate is a reference rate that is used in currency derivatives such as forex swaps (discussed in some detail in a separate section). It is determined at a specific time.

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In the case of the quotation USD/LCC 7.34 / 7.35 this must be seen as the quote of a market maker in currencies, i.e. a bank. The price on the left of the slash is always the buying price of the base currency and the other price the selling price of the base currency. These prices are also referred to as *bid and offer* rates / prices, respectively. The bank is *bidding* to buy the base currency against the variable currency at the *cheaper* price of LCC 7.34, and *offering* the base currency against the variable currency at the *dearer* price of LCC 7.35. Some dealers may call these prices *bid and ask*. An example may be useful:

Successful bid:	USD 1 000 000 at USD/LCC 7.34	= LCC 7 340 000
Successful offer:	USD 1 000 000 at USD/LCC 7.35	= LCC 7 350 000

The bank's cash flows are:

Outflow (it bought USD 1 000 000 at USD/LCC 7.34)	= LCC 7 340 000
Inflow (it sold USD 1 000 000 at USD/LCC 7.35)	= LCC 7 350 000

The bank's profit is LCC 10 000 (LCC 7 350 000 – LCC 7 340 000).

It will be evident that the bid and offer prices of the bank are the reverse of those of the clients of the bank. Mining House A *sold* (*offered*) USD 1 000 000 to the bank at the bank's buying price and received (inflow) LCC 7 340 000, and Importer A *purchased* (*bid*) USD 1 000 000 at the bank's offer rate and paid (outflow) LCC 7 350 000.

As we saw earlier, the banks in their role as market makers make bid and offer prices simultaneously. This means that when a client approaches a bank for a quote, the bank would quote, in the case of USD/LCC, say "7.34 / 7.35". The bank makes this quotation without knowing whether the client is a buyer or a seller, and the client can deal on either side of the quote, i.e. sell or buy the base currency, the USD.

In the foreign exchange markets activity is frenetic, and quotations are made every few seconds. In order to economise on time the "big figure" is usually not mentioned; only the "small figure", for example "34 / 35", or even "4 / 5", is mentioned. This is because active participants know where the big numbers are. Only in the case of non-bank clients that are not active will the "big figure" also be mentioned.

1.8 Spread

The difference between the bid and offer rates, surprisingly, is referred as the bid-offer spread. If a quotation of GBP/USD 1.6747 / 1.6757 is made, the bank bids for the base currency (GBP) at USD 1.6747 and offers the GBP at USD 1.6757. The spread is GBP/USD 0.001. In percentage terms this is equal to:

$$\begin{aligned}\text{Spread} &= [(1.6757 - 1.6747) / 1.6747] \times 100\\ &= (0.001 / 1.6747) \times 100\\ &= 0.000597 \times 100\\ &= 0.0597\%.\end{aligned}$$

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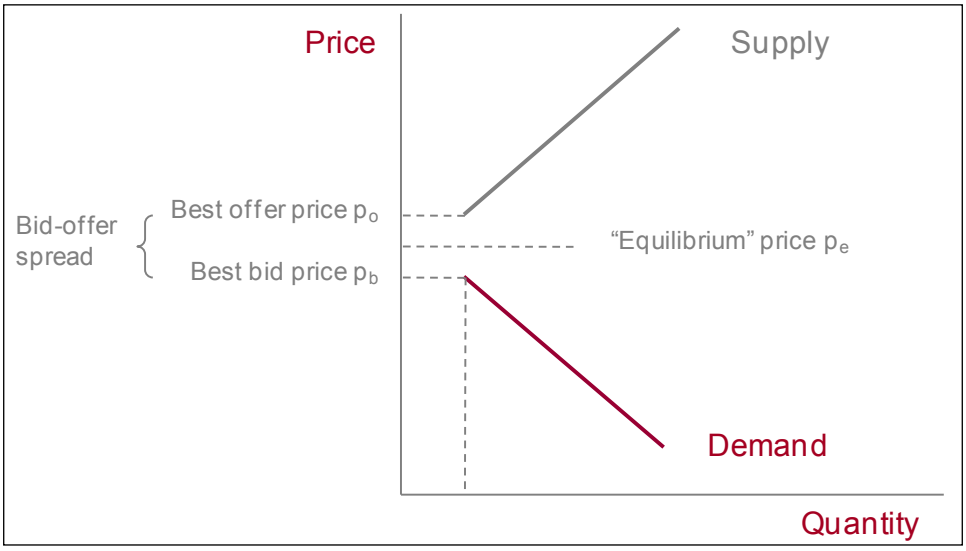

Figure 6: bid-offer spread (narrow, shallow market)

The bid-offer spread provides a good indication of the depth of the market. Thinly traded currencies will have a wider spread than more liquid currencies. During times of uncertainty the spreads in liquid markets can widen. Figure 6 illustrates a wide spread (indicating a narrow, shallow market) and Figure 7 a narrow spread (indicating a broad, deep market).

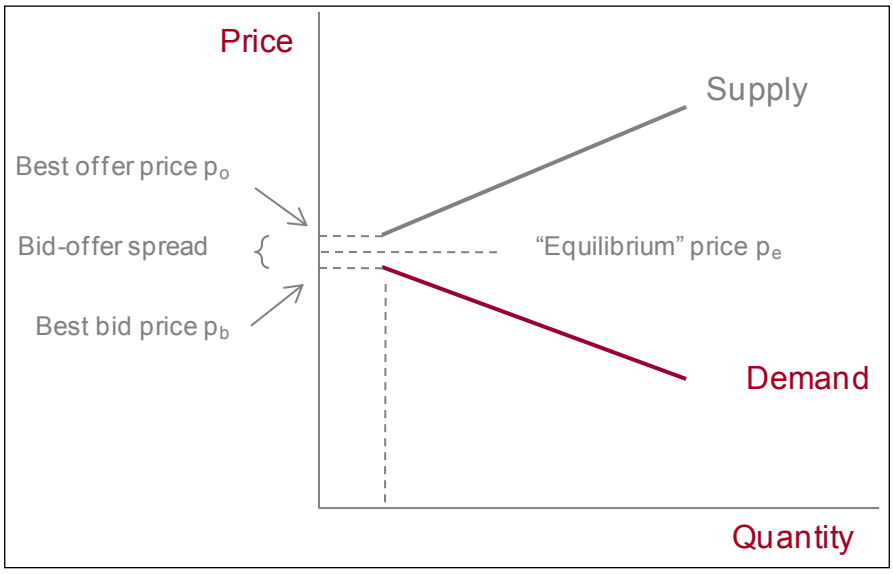

Figure 7: bid-offer spread (broad, deep market)

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1.9 Cross rates

The USD is sometimes called the *vehicle currency* because every country trades its currency in terms of the USD. Thus, one can get a USD/LCC quote, a USD/ZWD (Zimbabwe dollar) quote, a USD/SKK (Slovakia koruna) quote, a USD/UYP (Uruguay peso) quote, etc, but one cannot get a "straight" LCC/UYP or a LCC/ZWD quote, or even a GBP/LCC quote. The following is pertinent in this regard:

- All of the smaller countries of the world do not trade in their own currencies with one another.
- All currencies trade against the USD.
- Historically the interbank forex market has traded currencies against the USD, because the participants wanted to keep the number of individual quoted rates / prices to a minimum. There are some 190 currencies that have ISO codes. Imagine the combinations![10]
- Even if there was trade between all currencies, the liquidity in each market would be low indeed. With each currency trading against the USD, liquidity is reasonable or high, producing the positive consequence that the rates between non-USD currencies are *more efficient*.

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	Home currency per foreign currency unit (read columns)					
Foreign currency per home currency unit (read rows)		USD	ZAR	GBP	JPY	EUR
	USD	1	10.1813	0.6561	120.4800	1.0218
	ZAR	0.0982	1	0.0645	11.8063	0.1004
	GBP	1.5241	15.5153	1	181.818	1.5574
	JPY	0.0083	0.0847	0.0055	1	0.0085
	EUR	0.9787	9.9632	0.6421	117.5712	1
Source: Cape Times (adapted from). For the sake of easiness we ignore two-way quotes here.						

Table 3: Currency cross rates

In the case of non-USD currencies, rates, / prices are calculated from the prices of the relevant currencies against the USD. The results of these calculations are called *cross rates*. The definition is thus: *a cross rate is an exchange rate between two currencies, neither of which is the USD*. Examples are of cross rates are shown in Table 3.

It will be apparent that the term *cross rate* does not apply to the exchange rates against the USD shown in the table, *because all currencies are quoted in terms of the USD*. The following should be noted in respect of interpretation of the numbers (which are arbitrary) in the table (here we ignore two-way quotes):

- Reading from top to bottom (columns) we have GBP/LCC 15.5153, and EUR/LCC 9.9632. In the euro column we have USD/EUR 1.0218, GBP/EUR 1.5573, and JPY/EUR 0.0085, and so on.
- Reading from left to right (rows) gives the reciprocals of the above-mentioned exchange rates. Examples in the rand row are: LCC/JPY 11.8063, LCC/EUR 0.1004, and so on.

As shown above, all currencies are quoted in terms of the USD, but not in terms of other currencies (except in a few cases). For example, if the company Toyota Local Country Limited requires JPY 5 000 000 to pay for imports of motor car parts, its Local Country authorised foreign exchange dealer banker will not be able to provide a "straight" quotation of the LCC in terms of the JPY. This will have to be worked out by "crossing" exchange rates.

The exchange rate between the LCC and the USD is known, say USD/LCC 10.1813 (as in the table), as is the USD/JPY exchange rate, say USD/JPY 120.4800. The LCC/JPY exchange rate is then calculated as follows:

The givens are:

USD/LCC 10.1813
USD/JPY 120.4800.

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The USD is common to both ratios; therefore:

LCC 10.1813 = JPY 120.48.

The next step is to divide both sides of the equation by the number that applies to the currency that one wants as the base currency, in this case 10.1813:

LCC 10.1813 / 10.1813	= JPY 120.48 / 10.1813
	= LCC/JPY 11.8335.

The latter is the cross rate, with the LCC as the base currency. Should one wish the JPY to be the base currency, then:

JPY 120.48	= LCC 10.1813
JPY 120.48 / 120.48	= LCC 10.1813 / 120.48
	= JPY/LCC 0.08451.

Alternatively, the reciprocal of LCC/JPY 11.8335 can be calculated.

Note that these numbers do not tie in exactly with the numbers in Table 1.2 – this is because of the number of decimals used. Note also that there is *no international convention for the method of quoting a cross rate*, i.e. which is the base currency and which is the variable currency. However, usually the base currency is the "larger" currency (read larger economy). For example, the GBP/LCC cross rate will be GBP/LCC 15.5153, i.e. the greater GBP will be the base currency and the LCC the variable currency. Another example is EUR/LCC 9.9632.

Reverting to the earlier example: the principle may be written as follows:

CR_{bc} = (vc per USD1) / (bc per USD1)

where

CR_{bc}	= cross rate of variable currency per *base currency (one unit)*
vc	= variable currency
bc	= base currency.

Using the above numbers:

CR_{bc}	= (vc per USD1) / (bc per USD1)
	= 10.1813 / 120.48
	= 0.08451

which is written as JPY/LCC 0.08451, and the reciprocal is LCC/JPY 11.833.

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Toyota Local Country will pay JPY 5 000 000 × 0.08450614 = LCC 422 530.71, which is the same as JPY 5 000 000 / 11.83345938 = LCC 422 530.71 (note that the number of decimals was increased in order to arrive at the same numbers).

It will have been noted that this was an example of the cross rate derived from two currency rates that are quoted in *indirect (European)* terms. We now provide an example of the calculation of cross rates between a currency rate quoted in *direct (American)* terms and one quoted in *(indirect) European* terms:

A Local Country motorcar importer wishes to buy EUR1 million to pay for the importation of 10 Mercedes Benz 500SLs. There is no direct quote between the EUR and the LCC, so the calculation is:

The givens are:

USD/LCC 10.1813
EUR/USD 0.9787.

Simply calculate the reciprocal of EUR/USD 0.9787 = USD/EUR 1.0218

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The givens are now:

USD/LCC 10.1813
USD/EUR 1.0218.

We write these as:

LCC 10.1813 = EUR 1.0218, and divide each by 10.1813

= LCC/EUR 0.10036
= EUR/LCC 9.9641.

If we use the formula:

CR_{bc} = (vc per USD1) / (bc per USD1)

the cross exchange rate EUR/LCC:

= EUR/LCC (10.1813 / 1.0218)
= EUR/LCC 9.9641.

The reciprocal is:

= LCC/EUR (1 / 9.9641)
= LCC/EUR 0.10036.

The importer will pay EUR 1 000 000 × 9.96408299 = LCC 9 964 082.99, which is the same as EUR 1 000 000 / 0.10036046 = LCC 9 964 082.99 (note here also that the number of decimals was increased in order to arrive at the same numbers).

In the case of the calculation of cross rates between two currencies quoted in *direct (American)* terms:

EUR/USD 0.9787
GBP/USD 1.5241.

To obtain cross rate GBP/EUR, divide GBP/USD 1.5241 by EUR/USD 0.9787 = GBP/EUR 1.5574

To obtain cross rate EUR/GBP, divide EUR/USD 0.9787 by GBP/USD 1.5241 = EUR / GBP 0.6421.

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We conclude with the calculation of cross rates in the case of *two-way rates*. We use the example where both currency rates are quoted in *indirect (European)* terms:

USD/LCC 10.2545 / 50
USD/JPY 120.4850 / 60.

In the case of the bid: LCC 10.2550 (offer) = JPY 120.4850 (bid), divide by the LCC offer:

= LCC/JPY 11.7490.

In the case of the offer: LCC 10.2545 (bid) = JPY 120.4860 (offer), divide by LCC bid:

= LCC/JPY 11.7496.

Therefore: LCC/JPY 11.7490 / 96.

1.10 Foreign exchange risk: appreciation and depreciation

At first glance it may seem irrelevant which way an exchange rate is expressed. However, it is important because the words *appreciation* and *depreciation* of a currency are used in the market, and this may be confusing if the wrong method is used. A discussion on this follows.

If the USD/LCC exchange rate changes from USD/LCC 10.23 to USD/LCC 10.56, it may seem to some that the LCC has appreciated. However, it has actually depreciated. In the first case, LCC 10.23 was required to purchase USD 1, whereas in the second case, LCC 10.56 was required. This means that the *USD has appreciated* and the *LCC has depreciated*.

When these two exchange rates are inverted, they become LCC/USD 0.09775 and LCC/USD 0.09470. The same conclusion is arrived at: fewer USD are acquired per LCC in the second case compared with the first. The *LCC has depreciated* against the USD, and the *USD has appreciated* against the LCC.

It is to be noted that the *LCC depreciation and the USD appreciation are not the same in percentage terms*. If for example the USD/LCC exchange rate shifts from USD/LCC 10.23 to USD/LCC 13.80 (as it did in the latter part of 2001) it has changed by +LCC 3.57 per USD. The Local Country buyer of USD has to pay LCC 3.57 *more per USD*. Thus, the USD has *appreciated* by 34.897% over the period (for calculation see below).

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It is important to highlight two issues here. The first is that the terms appreciation and depreciation must be used with care. In the above example, where the USD appreciated by 34.897%, some would say that the converse also applies, i.e. that the LCC depreciated by 34.897%. *This is not the case.* The LCC depreciated by a different percentage. The rule that applies here is that the currency that appreciates or depreciates is the one with the *one unit*, i.e. the base currency and not the variable currency. In the above case the currency with one unit in terms of which the number of LCC is expressed is the USD.

The second point is *over the period* is mentioned because the USD appreciated between the day the LCC was quoted as USD/LCC 10.23 and the day the LCC was quoted as USD/LCC 13.80. Therefore it is not an annual rate; it is a *change over a period*.

The calculation of the depreciation or depreciation in percentage terms is as follows:

$$[(ER_1 - ER_0) / ER_0] \times 100$$

where

ER_0 = exchange rate at the original time = USD/LCC 10.23
ER_1 = exchange rate at the new time = USD/LCC 13.80.

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In the above example:

$$\begin{aligned}\text{\% change in exchange rate} &= [(ER_1 - ER_0) / ER_0] \times 100 \\ &= [(13.80 - 10.23) / 10.23] \times 100 \\ &= (3.57 / 10.23) \times 100 \\ &= 34.897\%.\end{aligned}$$

As noted, this is the *percentage change in the USD*, and this is because the USD is the base currency. The *extent to which the LCC depreciated* is calculated by inverting the above two exchange rates, i.e. to number of USD in terms of one LCC. The LCC becomes the base currency. The following are the relevant numbers:

$ER_0 = 1 / 10.23 = \text{LCC/USD } 0.09775$
$ER_1 = 1 / 13.80 = \text{LCC/USD } 0.07246$

$$\begin{aligned}\text{\% change in exchange rate} &= [(ER_1 - ER_0) / ER_0] \times 100 \\ &= [(0.07246 - 0.09775) / 0.09775] \times 100 \\ &= (-0.02529 / 0.09775) \times 100 \\ &= -25.872\%.\end{aligned}$$

In this case the LCC *depreciated* by 25.872%, but the USD did not appreciate by 25.872%; it certainly *appreciated,* but it did so by 34.897%, as shown above.

Another quirk in this respect is the following: a currency can depreciate from a particular rate to another and revert back to the *original rate*, and the percentage changes do not indicate that this has taken place. An example is given in Table 4.

It may be seen from the table that the USD/LCC moved from USD/LCC 10 on T+0 to USD/LCC 13 on T+30, and then moved back to the original rate of USD/LCC 10 on T+60. However, in percentage terms the USD appreciated by 30% in the first period and then depreciated by 23.08% in the second period, despite the fact that the original exchange rate was reached. The converse is true in the case of the LCC/USD rate.

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Day	USD/LCC		LCC/USD	
	Rate	% change in USD	Rate	% change in LCC
Day T+0	USD/LCC 10	-	LCC/USD 0.10000	-
Day T+30	USD/LCC 13	30.0%	LCC/USD 0.07692	-23.1%
Day T+60	USD/LCC 10	-23.1%	LCC/USD 0.10000	30.0%

Table 4: Percentage change in exchange rates

1.11 Spot and derivative forex markets

Spot transactions, as described earlier, are transactions done for settlement at the earliest possible and convenient date (because of "backroom" confirmation of deals, arrangements for settlement, and other administration). In the foreign exchange market this is T+2, i.e. settlement takes place 2 business days after the deal is transacted (T+0).

In addition to the spot market there is a substantial forex derivative market, comprised of:

- Forwards
- Futures
- Options
- Swaps

and there are a number of subcategories under each of these, such as, in the case of the forward market: *forex swaps*, *forward-forwards*, *option-date forwards*, and *outright forwards.* Of these derivative markets, the forward market is the largest.

The *forward foreign exchange market* is the market for the settlement of deals done now at T+0 and settled at dates in the future, i.e. on dates other than the spot settlement date of T+2. Forward contracts are usually available for forward periods of 1 month, 3 months, 6 months, 9 months and 12 months (the precise number of days is specified of course). However, while quotes are available for these periods, banks do deals for periods between these standard forward periods, i.e. they are willing to customise forward deals for clients. Clearly, a forward exchange *rate* differs from a spot rate on deals done on the same day.

We will return to the derivative markets later.

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1.12 Why exchange rates are important

Exchange rates are important because they affect the relative price of foreign and local goods, and the relative value of investments. Clearly, the price of US goods for a Local Country importer is a function of two factors:

- The price of the goods in USD
- The USD/LCC exchange rate

If an HP laptop computer in the US costs USD 2 000 and the LCC/USD exchange rate is USD/LCC 10 on T+0, the computer will cost LCC 20 000 (2 000 × LCC 10). If the purchaser waits for 3 months to T+91 days, and the exchange rate moves to USD/LCC 10.5 (i.e. the USD appreciates and the LCC depreciates), assuming the USD price of the computer remains unchanged at USD 2 000, the computer will cost LCC 21 000 (i.e. 2 000 × LCC 10.5).

Similarly, if a US citizen had waited from T+0 to T+91 days before purchasing a giraffe costing LCC 100 000 for his/her zoo, s/he (assuming the price of the giraffe over the period remained unchanged in LCC), would have saved USD 500.00:

T+0: USD/LCC 10.0 = LCC/USD 0.10; 100 000 × USD 0.1 = USD 10 000
T+91: USD/LCC 10.5 = LCC/USD 0.095; 100 000 × USD 0.095 = USD 9 500.

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It will be apparent that because of the LCC depreciation (USD appreciation) the price of US goods in LCC terms increased. By the same token, the prices of Local Country goods in USD terms fell. Thus, LCC depreciation lowers the cost of Local Country goods in America, but raises the cost of American goods in Local Country.

The conclusion reached is:

Currency depreciation leads to that country's goods becoming cheaper in foreign countries, and foreign countries' goods becoming more expensive in the country. Currency appreciation leads to that country's goods becoming more expensive in foreign countries, and foreign countries' goods becoming cheaper in the country.

It will be evident therefore if the USD appreciates meaningfully, it becomes more difficult for US exporters to export. It is difficult for the US to compete with other countries whose currencies have not appreciated. This is because their (US) goods become more expensive offshore. At the same time, foreign goods become cheaper in the US, leading to higher US imports. It also becomes cheaper for Americans to travel abroad. The consequence of course (depending on the circumstances) is that this situation is usually not sustainable, and eventually leads to USD depreciation.

1.13 Summary

The forex market is not a financial market; it is a conduit to foreign financial markets (in the first instance). It is the market for the exchange of one currency for another, for example LCC for USD. Exchange rates are quoted as one unit of one currency (called the base – or vehicle – currency = the USD in the overwhelming majority of cases) for a number of units (or parts of units) of the other currency (called the variable currency), for example USD/LCC 10.345.

The forex market is a quote-driven market "made" by the large banks. Because most currencies are quoted in relation to the USD, cross rates need to be calculated where the other currency is not the USD. Exchange rates are important because they affect the cost of imports and exports and investments, and they have an effect on inflation. There are a number of forex derivatives; the most utilised derivative is the forex forward.

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2 Derivatives: forwards

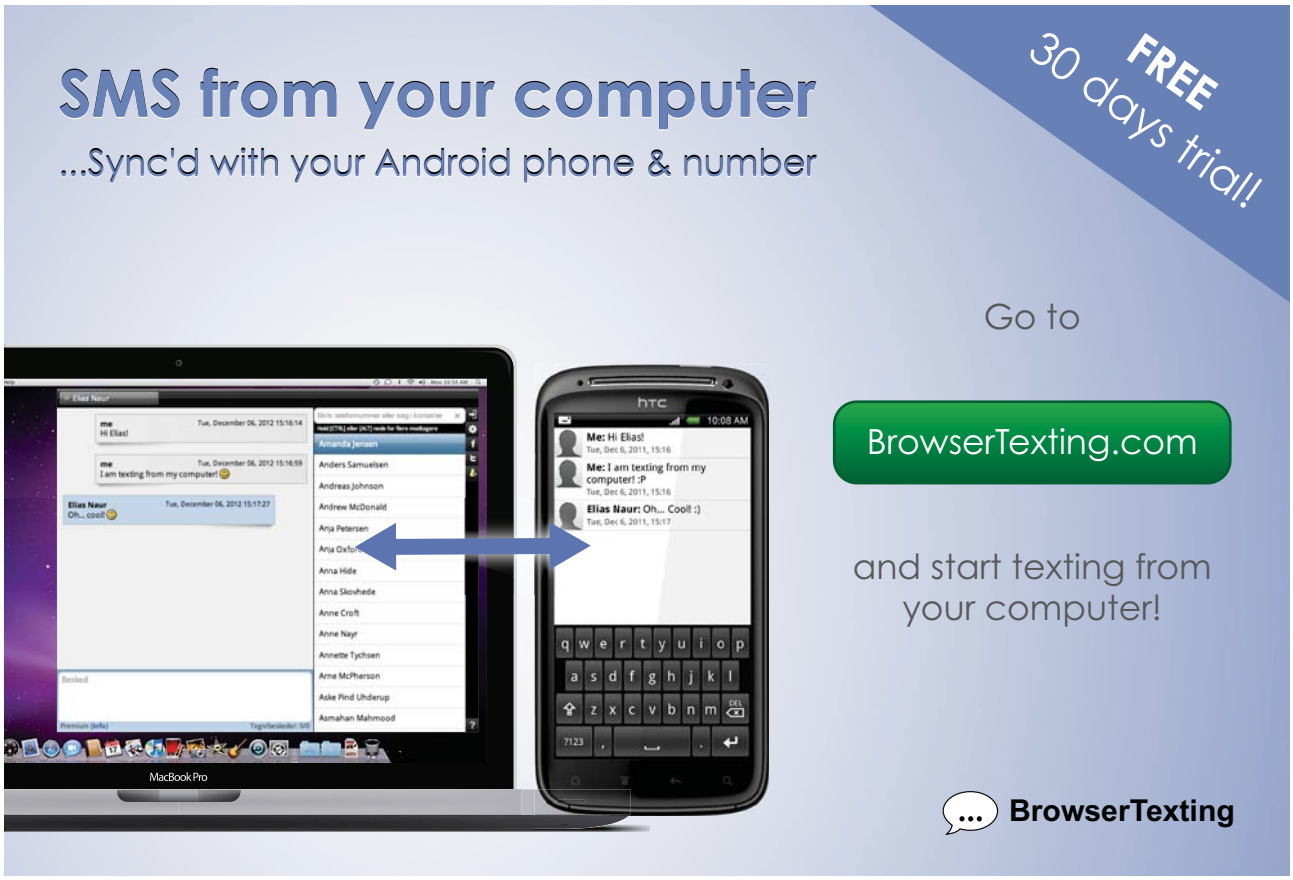
2.1 Learning objectives

After studying this text the learner should / should be able to:

- Describe the forward forex market in terms of the broad financial derivative markets.
- Define the forward forex market.
- Explain and analyse the types of forward forex instruments.
- Examine the largest element of the forward forex market, outright forward foreign exchange contracts, in terms of functions and pricing.
- Describe the organisation of the forward foreign exchange market.

2.2 Introduction

There are two main types of exchange rates quoted in the foreign exchange market at all times: spot rates and forward rates. We also noted that the banks quote bid and offer rates for standard periods: 1 month, 3 months, 6 months, 9 months and 12 months (in actual number of days), and that banks "make" forward rates also for periods that fall between the standard periods.



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In this text we discuss the significant forward market under the following headings[11]:

- Derivatives markets.
- Definition of a forward.
- Types of forwards.
- Outright forward foreign exchange contracts: functions and pricing.
- Forward exchange market.

The first section is designed to orientate the student.

2.3 Derivatives markets

One way of categorising derivatives markets is as in Figure 1, which shows very simply that all the spot financial markets (and the non-financial commodities market) have derivatives markets.

However, it does not show the categorisation of derivatives and how they fit in with the cash (spot) financial markets. Figure 2 represents our attempt in this regard.

This classification indicates that the following derivatives apply to the foreign exchange market: forwards, futures, options, options on forwards / futures, swaps, and options on swaps. The detail in this regard is presented in Figure 3.

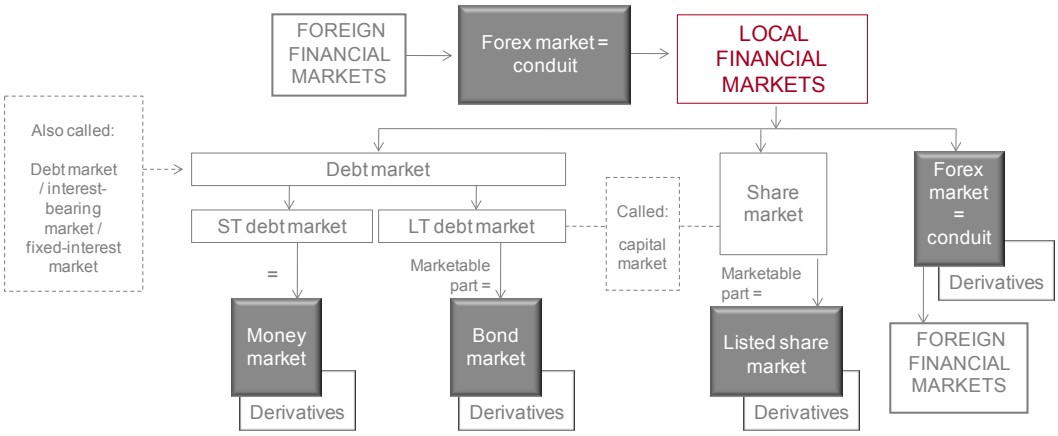

Figure 1: spot & derivative financial markets

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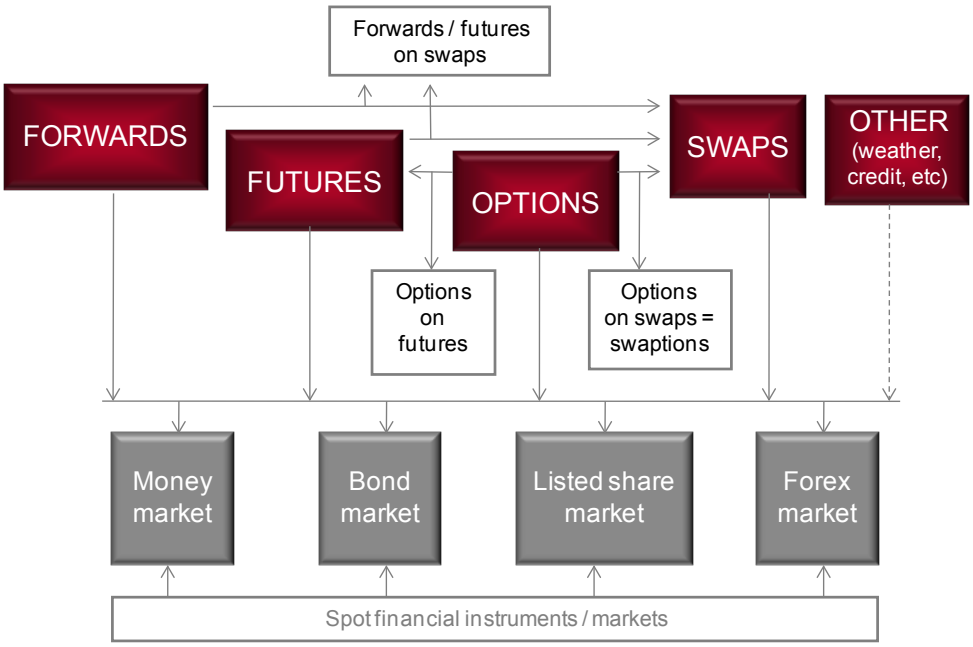

Figure 2: derivative instruments / markets

This text covers only the forward market, and another text is devoted to the foreign exchange derivatives other than forwards (futures, swaps and options). The forex forward market is a significance market compared to the other derivatives, i.e. trade in the forward forex market outstrips futures deals by a wide margin.

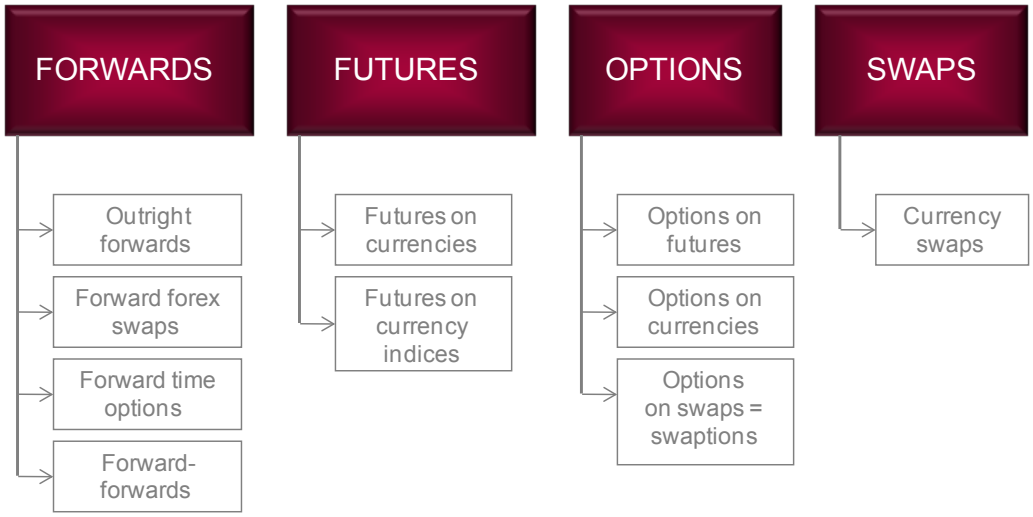

Figure 3: derivative instruments of the forexmarket

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2.4 Definition of a forward

A forward market is a market where a deal on some asset is concluded now (T+0) for settlement on a date in the future (other than the spot date of T+2) at a price determined now. *The motivation for such a deal by a bank client is usually that the spot price that will prevail in the future is uncertain, ie risk is present*. The forward purchase or sale is therefore done to coincide with a transaction (e.g. import or export) in order that the amount of the payment of forex / receipt of local currency (or vice versa) is certain (i.e. risk is eliminated). A simple example follows in order to elucidate the principle (see Figure 4).

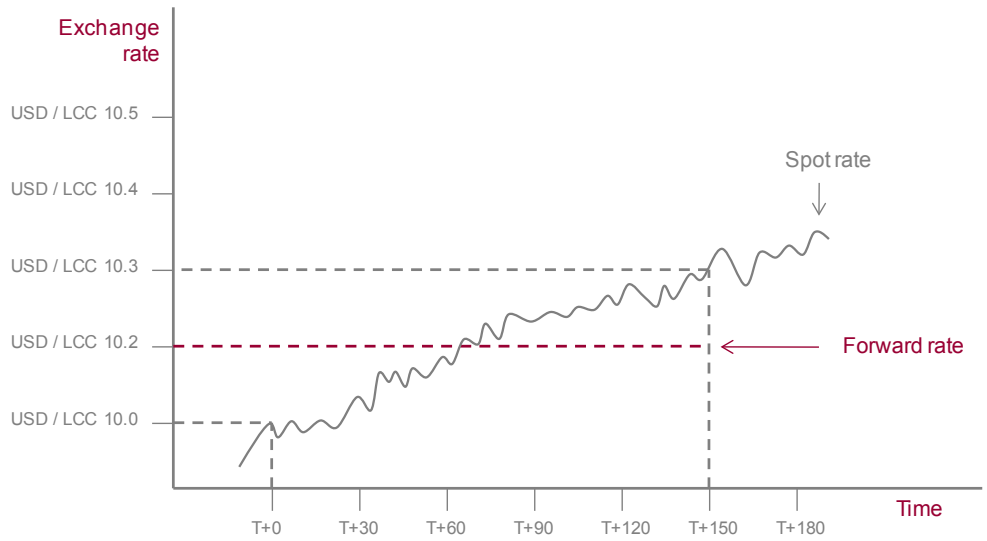

Figure 4: spot and forward rates

The *spot* USD/LCC rate *over time* is depicted in the chart. It is USD/LCC 10.0 on T+0 (now). On this day the forex forward rate for the T+150 period (i.e. 150 days from now) is quoted (selling) by a bank at USD/LCC 10.2. This means that a buyer of USD 1 000 000 in 150 days' time is able to enter into a contract now (on T+0) to purchase USD 1 000 000 on T+150 at an exchange rate of USD/LCC 10.2. On T+150 the spot rate is USD/LCC 10.3, but the holder of the forward exchange contract (with the bank) pays the price USD/LCC 10.2 for the USD 1 000 000, i.e. LCC 10 200 000 instead LCC 10 300 000.

We are now able to define a forward foreign exchange contract: *A contract established at time T+0 for a buyer to buy, and a seller to sell, a specific amount of foreign exchange on a specified future date (other than the spot settlement date) at a price agreed on T+0.* Clearly, the price to be paid does not change during the life of the contract, as depicted in the illustration.

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2.5 Types of forwards

2.5.1 Introduction

The above was a simple example of a forward deal between a bank and a client (say a company). In real life the majority of forwards are traded interbank, and are called *swaps*. The example above is also not realistic because the bank is not in the business of making losses. It will do the forward deal at a rate that will not produce a loss, but make a small profit. As this statement is potentially bewildering, it is appropriate to elucidate the different types of deals found in the forward market. As mentioned earlier, there are four types of forward deals:

- Outright forwards.
- Forex swaps.
- Time options.
- Forward-forwards.

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2.5.2 Outright forwards

Outright forwards are forward foreign exchange contracts, i.e. contracts between the market making banks and clients, and may be defined as contracts in terms of which the banks undertake to deliver a currency or purchase a currency on a specified date in the future other than the spot date, at an exchange rate agreed upfront. We will revert to outright forwards in detail a little later. However, we mention the formula here as a teaser [this is the Fair Value Price (FVP) of an outright forward]:

$$\text{FVP (outright forward)} = SP \text{ x } \{[1 + (ir_{vc} \times d/365)] / [1 + (ir_{bc} \times d/365)]\}$$

where

SP = spot price / rate
ir_{vc} = interest rate on variable currency
ir_{bc} = interest rate on base currency
d = number of days

An example is called for:

Exchange rate: USD/LCC 8.0
USD 1-year rate: 4% pa
LCC 1-year rate: 10% pa.

$$\begin{aligned}\text{FVP (outright forward)} &= SP \times \{[1 + (ir_{vc} \times d/365)] / [1 + (ir_{bc} \times d/365)]\} \\ &= SP \times \{[1 + (0.10 \times 365/365)] / [1 + (0.04 \times 365/365)]\} \\ &= 8.0 \times (1.10 / 1.04) \\ &= 8.0 \times 1.0577 \\ &= 8.4615.\end{aligned}$$

Note that a quicker, but slightly inaccurate, way of calculating the FVP exists; it is given by:

$$\text{FVP (outright forward)} = SP \times \{1 + [(ir_{vc} - ir_{bc}) \times d/365]\}$$

Using the same numbers above we have:

$$\begin{aligned}\text{FVP (outright forward)} &= SP \times \{1 + [(ir_{vc} - ir_{bc}) \times d/365]\} \\ &= 8.0 \times \{1 + [(0.10 - 0.04) \times 365/365]\} \\ &= 8.0 \times 1.06 \\ &= 8.48.\end{aligned}$$

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The majority of forwards are done for standard periods of less than a year. When the period is longer than a year, the formula becomes:

$$\text{FVP (outright forward)} = SP \times [(1 + ir_{vc})^n / (1 + ir_{bc})^n]$$

where n = number of years. Clearly if the period is, for example, 430 days, then n = 430 / 365.

2.5.3 Forex swaps

Foreign exchange swaps (called *forex swaps* or just *swaps*) are the exchange of two currencies now at a specific exchange rate (which does not have to be the current exchange rate but usually is a rate close to the current rate – it is a benchmark rate) coupled with an agreement to exchange the two currencies at a specified future date at the specified exchange rate plus or minus the swap points.

Swaps points are also called *forward points* and are quoted, for example, as 590 / 600. The left side is the rate at which the quoting bank will buy LCC now for USD for resale after 30 days, and the right hand is the rate at which the quoting bank will sell LCC now for USD for repurchase after 30 days. It is important to note that the points run from the second decimal and are in terms of price (of the variable currency). An example is called for (see Table 1 – quoting bank = Bank A):[12]

USD/LCC exchange rate	= USD/LCC 7.5555 / 7.5565
Agreed exchange rate benchmark	= USD/LCC 7.560
Swap points quote by quoting bank	= 590 / 600 (= LCC 0.059 / 0.060)
Deal size	= USD 1 000 000
Term	= 30 days

Date	Quoting bank (Bank A)	Customer (Bank B)	Customer (Bank C)
Swap deal date	- USD 1 000 000 + LCC 7 560 000	+ USD 1 000 000 - LCC 7 560 000	
30 days later	+ USD 1 000 000 - LCC 7 619 000	- USD 1 000 000 + LCC 7 619 000	
Net cash flow	- LCC 59 000	+ LCC 59 000	

Table 1: Cash flows (1)

The customer (Bank B) wants to buy USD for LCC and sell USD for LCC after 30 days. The deal is unwound after 30 days at the agreed exchange rate plus the forward points (LCC 7.56 + LCC 0.0590 = LCC 7.619) (which reflects the interest rate differential). The quoting bank makes a loss of LCC 59 000. However, this is one side of the deal. The bank has a customer with the opposite requirement (see Table 2).

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Date	Quoting bank (Bank A)	Customer (Bank B)	Customer (Bank C)
Swap deal date	+ USD 1 000 000 - LCC 7 560 000		- USD 1 000 000 + LCC 7 560 000
30 days later	- USD 1 000 000 + LCC 7 620 000		+ USD 1 000 000 - LCC 7 620 000
Net cash flow	+ LCC 60 000		- LCC 60 000

Table 2: Cash flows (2)

The customer (Bank C) wants to sell USD for LCC and buy USD for LCC after 30 days. The deal is unwound after 30 days at the agreed exchange rate plus the forward points (LCC 7.56 + LCC 0.060 = LCC 7.62) (which reflects the interest rate differential). The quoting bank makes a profit of LCC 60 000. The net effect is shown in Table 3.

Date	Quoting bank (Bank A)	Customer (Bank B)	Customer (Bank C)
Swap deal date	USD 0 LCC 0	+ USD 1 000 000 - LCC 7 560 000	- USD 1 000 000 + LCC 7 560 000
30 days later	USD 0 + LCC 1 000	- USD 1 000 000 + LCC 7 619 000	+ USD 1 000 000 - LCC 7 620 000
Net cash flow	+ LCC 1 000	+ LCC 59 000	- LCC 60 000

Table 3: Cash flows (3)

This is an example of a matched deal. In practice there are many reasons for doing such deals, such as to take advantage of an expectation of interest rate changes, to take advantage of forward points that are out of line (it should be apparent that the price of a forex swap is the difference between the *spot price* and the *outright forward price* and the difference between the two is a reflection of the interest rate differential between the relevant currencies – discussed more fully below).

To make the above statement clear:

Forward swap = outright forward – spot

Outright forward = spot + forward swap

Outright forward = $\text{spot} \times [(1 + ir_{vc} \times d/365) / (1 + ir_{bc} \times d/365)]$

where

ir_{vc} = interest rate on variable currency

ir_{bc} = interest rate on base currency

d = number of days

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For example, if:

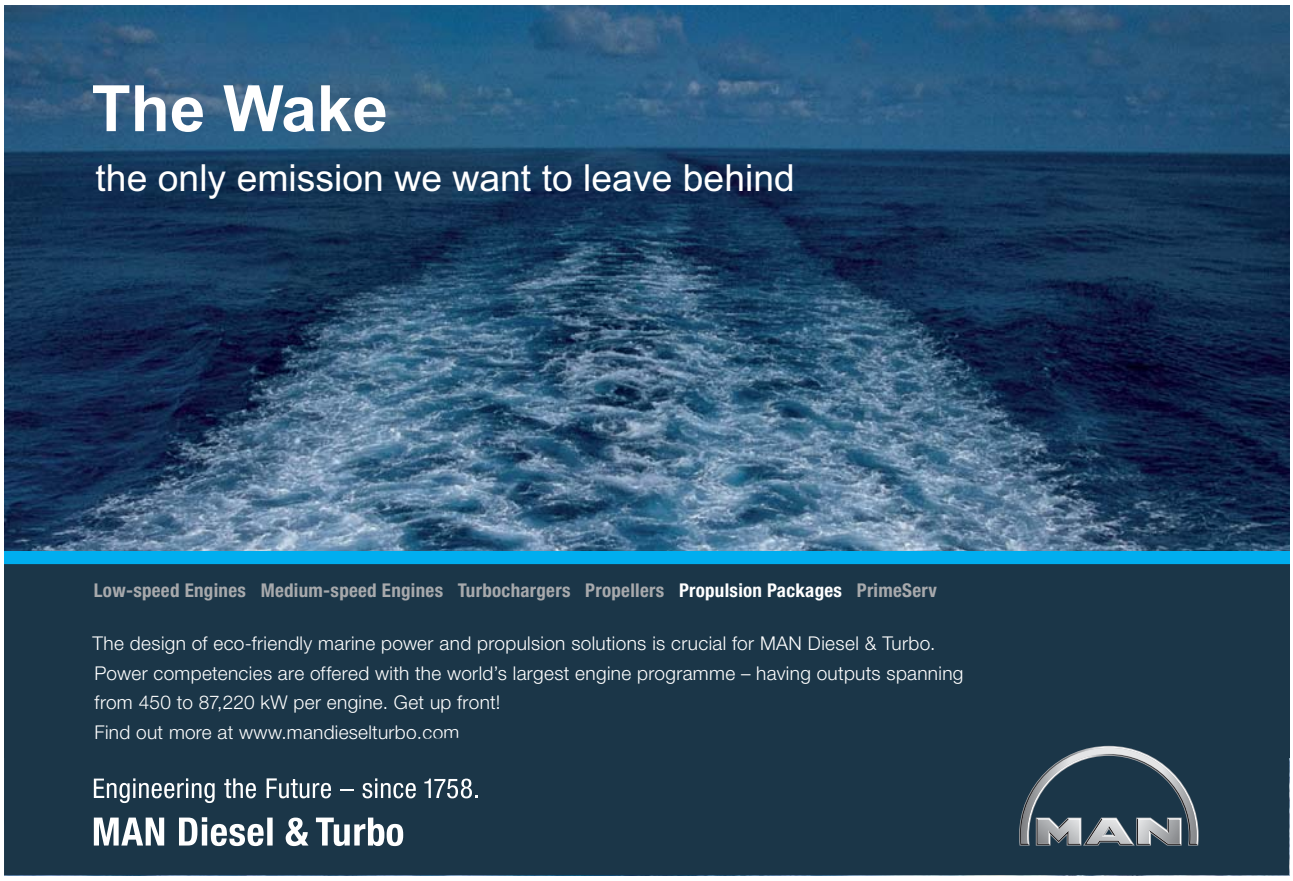
LCC	$= ir_{vc} = 10\%$
USD	$= ir_{bc} = 5\%$
Exchange rate	= USD/LCC 7.7000
Forward period	= 30 days

Outright forward	$= 7.70 \times [(1 + 0.10 \times 30/365) / (1 + 0.05 \times 30/365)]$
	$= 7.70 \times (1.008219 / 1.00411)$
	$= 7.70 \times 1.004093$
	$= 7.7315$

Forward swap	= outright forward – spot
	= 7.7315 – 7.7000
	= 0.0315

The forward swap points are 315, i.e. they run from the second decimal (here we obviously ignored the swap spread). A lesson to learn here is that if:

interest rate of the vc > interest rate of the bc



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then the forward swap points are *added* to the spot rate to arrive at the outright forward rate. To these issues we now turn (but after a brief discussion of swap terminology used in the forex market).

In conclusion, it is important clear up some terminology. The term swap is generally used to refer to interbank swaps as outlined above. However, in Local Country (LC) (and probably some other countries) the clients of banks (say companies like mining houses) also use the term swap. From the clients' perspective, a swap is "where the conditions of a forward contract are changed for whatever reason … An importer may need to change the terms of his forward contract due to shipping delays, to benefit from a stronger rand, to facilitate early repayment or when the contract is no longer required."[13]

A conversation with a forex dealer[14] at a treasury management company (TMC) revealed the following example of a *forex swap* executed on behalf of a Local Country mining house company (MHC)[15], i.e. this is an example of a swap as seen by a client in the non-interbank market:

The MHC is expected to have mined and refined gold to the value of about USD 1 000 000 (the gold price is quoted in USD) by 30/9. The MHC decides on 3/9 to sell this gold forward (because it expects the USD to depreciate / LCC to appreciate). It sells the gold forward (this is an *outright forward*) at a forward exchange rate (for 30/9) of USD/LCC 7.5635 (the spot rate is USD/LCC 7.50 and the forward points quoted by the bank are 0.0635 – as seen above forward rate = spot + forward points or swap).

On 28/9 the outright forward deal done by the MHC on 3/9 for 30/9 becomes a spot deal (because settlement is 2 days away). On this date the MHC informs the TMC that it will not have the gold to deliver on 30/9, and therefore will not have the USD 1 000 000 to deliver in terms of the outright forward exchange contract. However, the gold will be sold by late October, and it will have the funds (USD 1 000 000) on 30/10.

The TMC decides to execute the following deal on behalf of the MHC on 28/9 (assume the spot rate is unchanged at USD/LCC 7.50):

- The MHC buys spot USD 1 000 000 at USD/LCC 7.50
- The MHC sells USD 1 000 000 forward (outright forward) at the forward rate of USD/LCC 7.5650 (spot + forward points of 0.0650).

The MHC has closed off its original forward position (bought USD 1 000 000 for delivery on 30/9 in order to deliver USD 1 000 000 in terms of the forward exchange contract executed on 3/9), and "opened" another forward exchange contract in terms of which it will deliver USD 1 000 000 on 30/10 at an exchange rate of USD/LCC 7.565. The MHC is hedged on the exchange rate, and it will earn LCC 7 565 000 on 30/10 from the gold sale.

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In local lingo, the TMC has done a *forex swap* on behalf the MHC. Note that when such a deal is done forward of the spot date it is a forward-forward deal (discussed below). We shall return to the principle of forward pricing in a moment.

Of the four forwards, we have discussed outright forwards (full name: outright forward foreign exchange contracts) and forex swaps (full name: forward foreign exchange swaps). We now turn to the other two:

- Foreign exchange time options (full name: option-date forward contracts).
- Forward-forwards (full name: forward-forward foreign exchange contracts).

2.5.4 Time options

As noted above, when a bank does an *outright forward* it is undertaking to buy or sell a specified currency on a future date (other than the spot date) at an exchange rate specified at the outset. This type of contract does not suit every non-bank client. A client may have a requirement for a hedge but is not sure exactly when forex is required (an importer), or to be sold (an exporter). In these cases *forex time options* are appropriate instruments. This instrument is the same as an outright forward with the maturity date specified, but the client has the option to settle at any time within a specified period. The *specified period* may be anytime during the period of the contract, or anytime between a specified future date and the expiry date of the contract.

A forex time option (or option date forward) is not to be confused with a *currency option*. The holder of the latter has the option but not the obligation to buy (call) or sell (put) a specified currency at a specified strike rate before or on the expiry date. An option premium is payable, which is not the case with a time option. In the case of a time option, the *holder has the obligation to settle* but has *flexibility in terms of the settlement date*.

2.5.5 Forward-forwards

A forward-forward is a swap deal between two forward dates as opposed to an outright forward that runs from a spot to a forward date. An example is to sell USD 30 days forward and buy them back in 90 days' time. The swap is for the 60-day period *between* 30 days from deal date and 90 days from deal date. The backdrop to this deal may be that the client (company) previously bought USD forward (for the date 30 days from now) but wishes to defer the transaction by a further 60 days because it will not need the USD until then. This deal[16] is illustrated in Figure 5.

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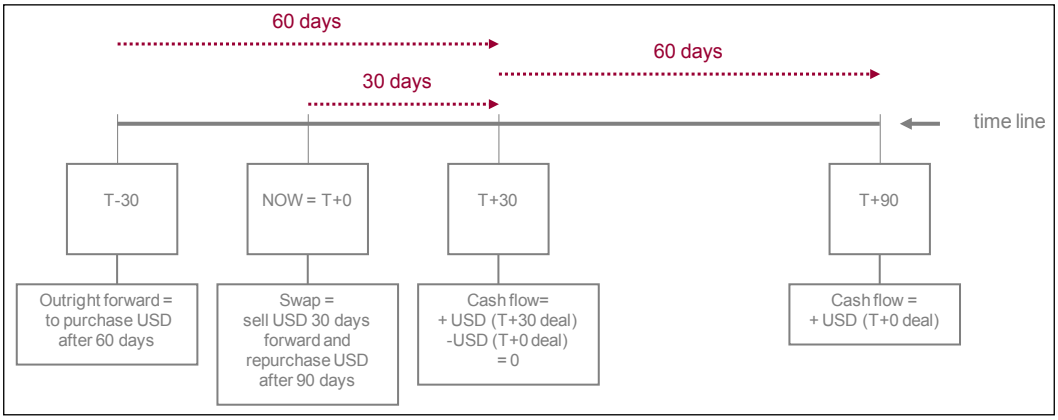

Figure 5: forward-forward deal

Variations of forward-forwards are *foreign exchange agreements* (FXAs) and *exchange rate agreements* (ERAs). Together they are referred to as *synthetic agreements for forward exchange* (SAFEs). The FXA is the same as a forward-forward as explained above, but on the first settlement date, T+30 in our example, the settlement takes place as in the case of a FRA, i.e. in *cash* reflecting the *difference* between the exchange rate set in the outright forward contracted on T-30 and the exchange rate set in the swap on T+0. The difference may be a profit or a loss for the client, which of course will be the reverse for the bank. An ERA is the same as a FXA, but takes no account of the movement in spot rates between T-30 and T+0.[17]

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2.6 Outright forward foreign exchange contracts: functions and pricing

2.6.1 Introduction

There are many reasons for the existence of the forward foreign exchange market, but outright forwards are essentially used to cover a number of risks that are encountered by investors and commercial companies that are engaged in importing and exporting. The four main uses of the forward market are:

- Commercial covering.
- Hedging an investment.
- Speculation.
- Covered interest arbitrage.

2.6.2 Commercial covering

The importation or exportation of goods and services results in one of the parties receiving payment and one making payment in foreign currency. An example is required: see Figure 6.

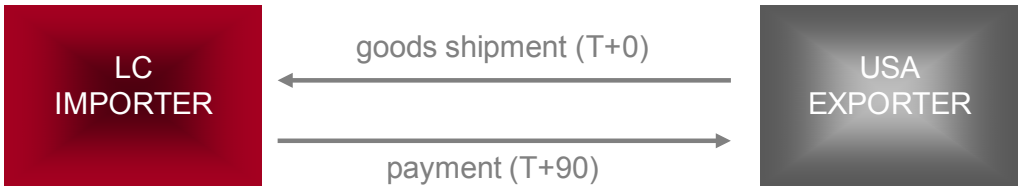

Figure 6: outright forward deal

The Local Country (LC) importer undertakes to pay for the goods in USD on arrival date, which is 90 days after shipment (T+90)[18]. The terms of the commercial transaction are agreed at the time of shipment (T+0), and includes that the price is USD 1 million. The importer has a problem: s/he knows what the USD/LCC exchange rate is now (USD/LCC 10), but has no idea what the exchange rate will be on T+90. If the rate falls to USD/LCC 10.5 during the 90-day period, the importer will have to pay LCC 10 500 000 to purchase USD 1 million, i.e. LCC 500 000 more.

In order to reduce the risk, the importer enquires from the dealing bank what the forward exchange rate is for 90 days. It is quoted at USD/LCC 10.20, and s/he accepts the quote. The importer has purchased a forward exchange contract, i.e. the bank has *contracted* to deliver USD 1 million to the importer on T+90 in exchange for LCC 10 200 000 (USD 1 000 000 × 10.2) in order to pay the foreign exporter. Clearly, on T+90 the importer pays LCC 10 200 000 for USD 1 000 000 (this is done as a credit to the importer's US bank account). The importer transfers the USD 1 million to the US exporter's account.

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The balance sheets of the relevant parties change as follows (ignoring profits taken and spreads):

LOCAL COUNTRY IMPORTER (LCC)			
Assets		Liabilities	
Goods (value) Bank deposits	+ 10 200 000 - 10 200 000		

US EXPORTER (USD)			
Assets		Liabilities	
Goods (value) Bank deposits	- 1 000 000 + 1 000 000		

LC BANKING SYSTEM (LCC)			
Assets		Liabilities	
US bank deposits	-10 200 000	Deposits (LC importer)	- 10 200 000

US BANKING SYSTEM (USD)			
Assets		Liabilities	
		Deposits (US exporter) Deposits (LC bank sector)	+1 000 000 - 1 000 000

If the spot rate of T+90 is USD/LCC 10.5, the importer will grin, because s/he saved LCC 300 000 [(LCC 10.5 × USD 1 000 000 = LCC 10 500 000) – (LCC 10.2 × USD 1 000 000 = LCC 10 200 000)]. However, if the spot rate on T+90 is unchanged at USD/LCC 10.0, s/he will frown, because the USD 1 000 000 would have cost LCC 10 000 000, and not LCC 10 200 000.

An obvious question that arises is why does the importer not buy the USD spot now and hold them until T+90? There may be two answers. The importer may not have the funds on T+0, but will have the funds on T+90 when the imported goods will have been sold. The second answer is that the importer can raise the funds now to buy the USD now, but may not wish to borrow the funds now to buy the USD because the cost on funds for the 90-day period may be higher than the difference between the spot rate and the forward rate (this attention-grabbing issue is discussed below).

It is to be noted that the importer is avoiding his/her foreign exchange risk by matching liabilities and assets. The liability is the amount to be paid on T+90, i.e. USD 1 million, and the asset is the forward purchase of USD 1 million.

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2.6.3 Hedging an investment

The market value of foreign investments can change as a result of fluctuations in the local currency vis-à-vis the currency of the country where the investment was made. In this case the investor can protect himself/herself by purchasing a forward currency contract. An example may be useful:

A US investor on T+0 buys GBP 1 million (a UK deposit) at a *spot* exchange rate of GBP/USD 1.25, i.e. s/he pays USD 1 250 000 for the deposit, and then buys a UK bond for GBP 1 million. The reason for buying the bond is that s/he expects UK rates to fall over the next 30 days, and would like to exit the investment after 30 days with a handsome capital profit. However, s/he is concerned about the value of the GBP over this period, and enquires about the 30-day GBP/USD forward rate from a US foreign exchange dealing bank. The quote is GBP/USD 1.20, and s/he accepts the quote. This means that the US bank has contracted to buy from the investor GBP 1 million on T+30 at an exchange rate of GBP/USD 1.20.

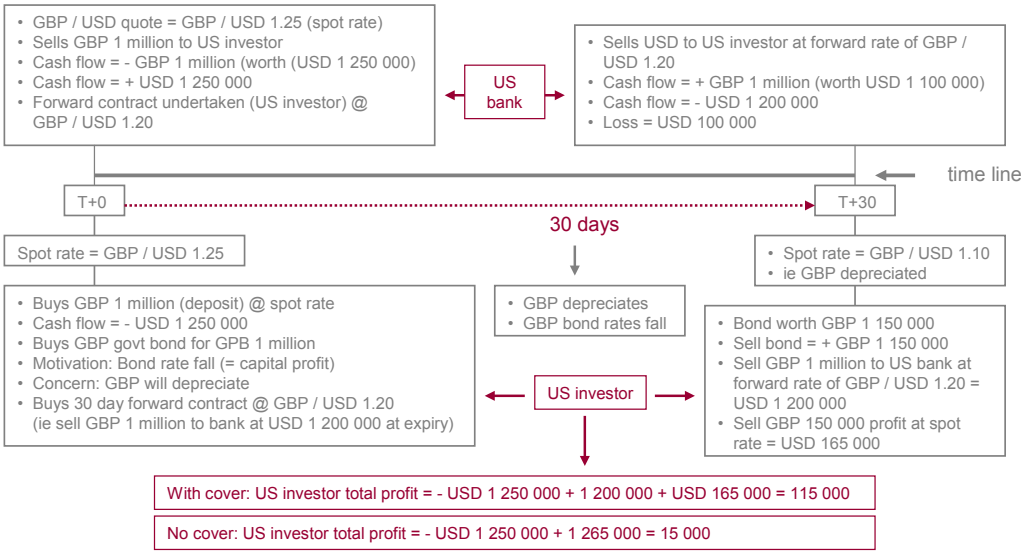

Figure 7: forward currency contract

On T+30 the *spot* exchange rate is GBP/USD 1.10 (i.e. the GBP has depreciated). The investor sells the bond for GBP 1 150 000 (the extra GBP 150 000 is a capital gain) and the funds are placed in the US investor's UK deposit account. The US investor then:

- Sells GBP 1 000 000 to the bank at the *contracted rate* of GBP/USD 1.20, and receives USD 1 200 000 (i.e. less than the original investment in USD terms – USD 1 250 000).
- Sells GBP 150 000 to the bank at the *spot exchange rate* of GBP/USD 1.10, and receives USD 165 000 (GBP 150 000 × 1.10)

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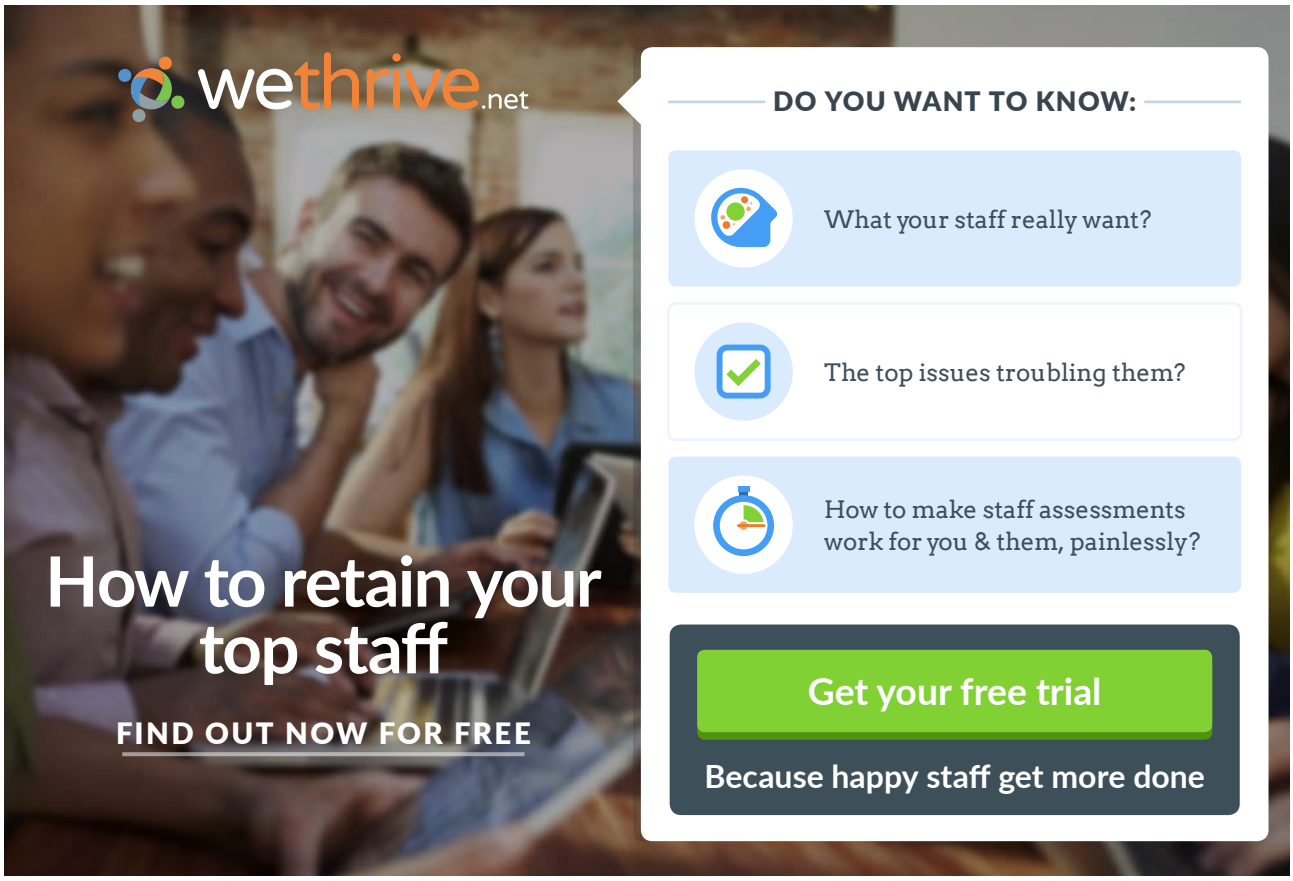
The investor's total receipt is USD 1 365 000, i.e. s/he made a profit of USD 115 000. Had s/he not covered forward, the GBP 1 150 000 proceeds of the investment would have been converted at the *spot rate* of GBP/USD 1.10, and s/he would have received USD 1 265 000 (GBP 1 150 000 × 1.10), i.e. s/he would have made a smaller profit of $15 000.

These transactions are illustrated in Figure 5.7.

2.6.4 Speculation

Speculation on future currency rates is a significant driver of foreign exchange markets and exchange rates. Speculators can purchase currency for future delivery if they are of the opinion that the spot rate on the future date will be higher than the current forward rate.

For example, if the current spot rate is GBP/USD 1.20, the forward rate for T+30 is GBP/USD 1.22, and the expected spot rate on T+30 is GBP/USD 1.25 (i.e. s/he expects the USD to depreciate against the GBP; the GBP to appreciate against the USD), a US speculator will buy a forward contact for GBP 1 000 000. S/he pays nothing for the contract on T+0 because s/he has contracted to buy the GBP 1 000 000 for USD1 220 000 on T+30 (GBP 1 million × 1.22).



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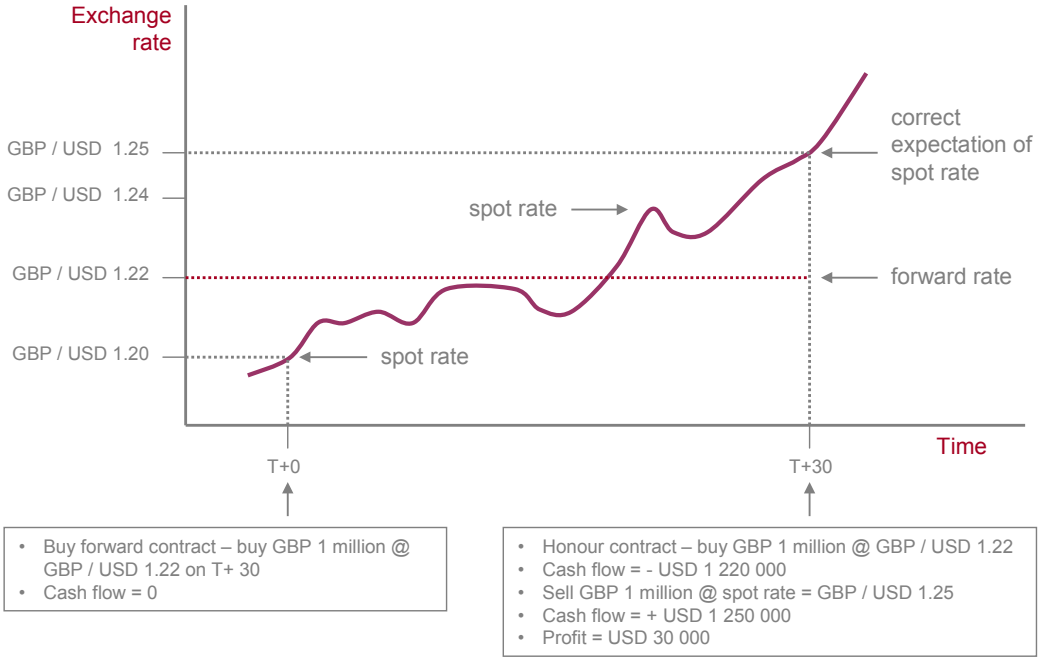

Figure 8: speculative forward exchange transaction

On the assumption that the forecast of the spot GBP/USD exchange rate on T+30 is correct (GBP/USD 1.25), the speculator takes delivery of GBP 1 000 000 and pays the contracted amount of USD 1 220 000. S/he immediately sells the GBP 1 000 000 at the *spot rate* of GBP/USD 1.25, and receives USD 1 250 000. The speculator's profit is USD 30 000 (USD 1 250 000 – USD 1 220 000).

This deal is illustrated in Figure 8.

2.6.5 Covered interest arbitrage

Interest rates around the world are not at the same level, and dealers and portfolio managers constantly seek out opportunities in this regard. An example of a covered interest arbitrage deal is as follows: the rate on the 3-year bonds of a UK retailer is 11% pa, and the rate on the 3-year bonds of an equivalent risk US retailer is 9% pa. This interest differential makes the US investor drool, and s/he decides to buy GBP 1 000 000 of the UK bond.

Clearly, the US investor is *buying GBP spot* and has to *sell GBP spot* upon receipt of the interest each year and the principal at the end of 3 years. The exchange rate must fall by more than the interest differential of 2% before the investor makes a loss. The investor is not prepared to take the risk and adopts a strategy of selling GBP forward on the relevant interest and principal delivery dates. The details of this important principle are covered in the following section.

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2.6.6 Principle of interest rate parity and the pricing of forward contracts

The example in the previous section points to an important rule in foreign exchange rates and international capital flows, and this is that:

The net rate of return from an investment offshore should be equal to the interest earned minus or plus the forward discount or forward premium on the price of the foreign currency involved in the transaction.

This says that the interest differential between two currencies is related to the forward discount or premium, and that *interest rate parity* is reached when the interest rate differential is equal to the discount or premium on one of the currencies.

Earlier we used the example of a spot rate of GBP/USD 1.25 and a 12-month forward rate of GBP/USD 1.23. This is also known as GBPs are selling at a 2-cent *discount* in the forward market (think: "less USD per GBP"), which is the same as saying that forward USDs are selling at a *premium* to spot USD (think: "more GBP per USD" – GBP 0.813 in forward market compared with spot market of GBP 0.80).

A reminder of the formula we introduced above for the forward rate:

$$\text{FVP (outright forward)} = SP \text{ x } [(1 + ir_{vc} \times d/365) / (1 + ir_{bc} \times d/365)]$$

where

SP = spot price / rate
ir_{vc} = interest rate on variable currency
ir_{bc} = interest rate on base currency
d = number of days

Example:

SP	= GBP/USD 1.2515
ir_{bc} (GBP)	= 9.6% pa
ir_{vc} (USD)	= 8.0% pa
Forward period	= 90 days

then

FVP (outright forward)

$$= SP \times [(1 + ir_{vc} \times d/365) / (1 + ir_{bc} \times d/365)]$$
$$= 1.2515 \times [(1 + 0.08 \times 90/365) / (1 + 0.096 \times 90/365)]$$
$$= 1.2515 \times (1.01973 / 1.02367)$$
$$= 1.2515 \times 0.99615$$
$$= 1.2467.$$

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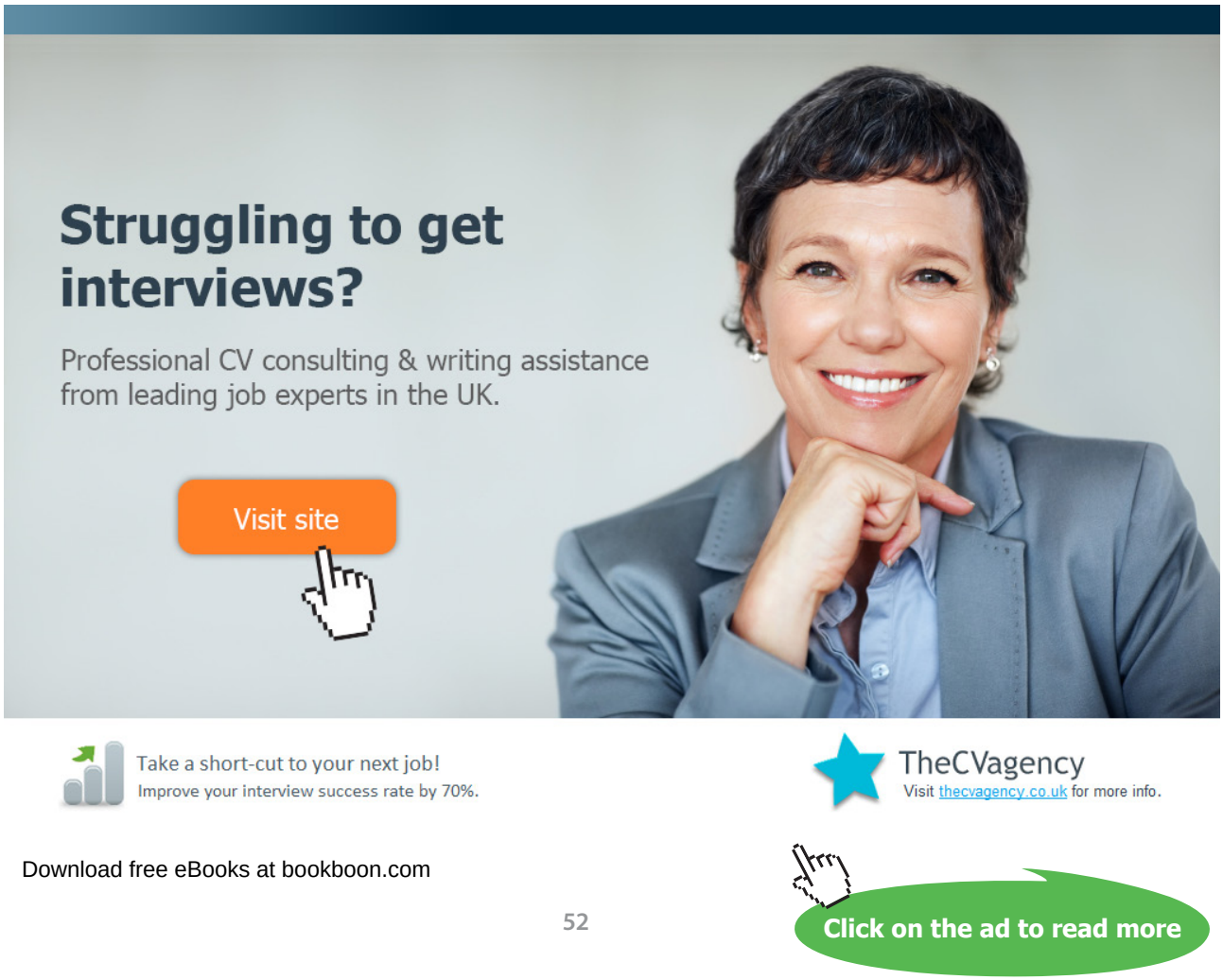
This means that the USD is selling at a premium in the forward market compared with the spot market and this is because the USD rate is lower than the GBP rate. The forward points are – 0.0048. Thus when the $ir_{bc} > ir_{vc}$, spot > forward rate, i.e. the forward points are negative. Conversely, when $ir_{bc} < ir_{vc}$, as in the case of the USD/LCC, then spot < forward rate, i.e. the forward points are added to the variable currency spot rate.

Another way of expressing the forward exchange rates is in terms of an *annualised percentage rate* above or below the current spot price. Using the rates above, the discount on forward GBP for delivery in 12 months is:

$$\text{Forward discount or premium} = [(FR - SR) / SR] \times (365 / FP) \times 100$$

where

FR = forward rate
SR = spot rate
FP = forward period in days



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Forward discount or premium

$$= [(FR - SR) / SR] \times (365 / FP) \times 100$$
$$= ((1.2467 - 1.2515) / 1.2515) \times (365 / 90) \times 100$$
$$= (-0.0048 / 1.2515) \times 4.0556 \times 100$$
$$= -0.0038 \times 4.0556 \times 100$$
$$= -1.6\%.$$

It tells us that 90-month GBP rates (base currency) are 1.6 percentage points pa higher than USD rates for the same term. Let us assume:

This is called the *covered interest parity* condition (the CIP condition), i.e. that *the interest rate differential between two countries will be reflected in the forward rate between them.* If this is not the case (which happens only briefly), then the arbitrageurs will ensure that this is the case, by buying / selling the relevant currencies and buying / selling forward contracts.

2.6.7 Example of arbitrage opportunity in the forward market

It may be useful to consider an arbitrage opportunity in the forward market. We assume that:

US one-year interest rate	= 8.0% pa
UK one-year interest rate	= 9.6% pa
Spot rate	= GBP/USD 1.25
1 year forward rate	= GBP/USD 1.25
Spot rate in 1 year's time	= GBP/USD 1.25

In this case a US investor can invest in the UK and earn a risk-free interest amount. S/he can buy GBP 1 000 000 (a UK deposit) for USD 1 250 000 (1.25 × GBP 1 000 000), and sell GBP 1 000 000 forward at GBP/USD 1.25 (i.e. GBP 1 000 000). The funds are invested in a 1-year UK NCD at 9.6% and earn GBP 96 000 over the year. The capital amount of GBP 1 000 000 is converted back into USD at the contracted rate of GBP/USD 1.25, i.e. USD 1 250 000. The interest amount is converted to GBP at the spot rate of GBP/USD 1.25 and this amounts to USD 120 000 (1.25 × GBP 96 000).

The return to the US investor is 9.6% [(USD 120 000 / USD 1 250 000) × 100]. The alternative for the US investor would have been a domestic USD investment at 8.0% pa.

Another example may be useful. We assume:

US one-year interest rate	= 8% pa
UK one-year interest rate	= 9.6% pa
Spot rate	= GBP/USD 1.25
1 year forward rate	= GBP/USD 1.20
Spot rate in 1 year's time	= GBP/USD 1.20

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The following numbers are applicable in the case of a US investor buying a GBP 1 000 000 UK NCD (via a bank account balance created by the foreign exchange deal done):

Cost (at spot rate)	= USD 1 250 000 (1.25 × GBP 1 000 000)
Interest earned over year	= GBP 96 000 (0.096 × GBP 1 000 000)
Conv'n of capital after 1 year	= USD 1 200 000 (1.20 × GBP 1 000 000)
Conv'n of interest after 1 year	= USD 115 200 (1.2 × GBP 96 000)
Total converted into USD	= USD 1 315 000
Total earnings	= USD 65 000 (USD1 315 000–USD 1 250 000)
Earnings in % pa	= 5.2% pa [(USD 65 000 / USD 1 250 000) × 100)]

Clearly, the US investor would not have done this deal because his/her earnings in the US would have been better at 8.0%.

However, a UK investor would be better off if s/he invests in the US (here we assume that the UK investor buys a USD 1 000 000 NCD). The following are the numbers:

Cost (at spot rate)	= GBP 800 000 (1 / 1.25 × USD 1 000 000)
Interest earned over year	= GBP 80 000 (0.08 × USD 1 000 000)
Conversion of capital after 1 year	= GBP 833 333.33 (1 / 1.20 × USD 1 000 000)
Conversion of interest after 1 year	= GBP 66 666.67 (1 / 1.2 × USD 80 000)
Total converted into GBP	= GBP 900 000
Total earnings	= GBP 100 000 (GBP 900 000 – GBP 800 000)
Earnings in %	= 12.50% pa [(GBP 100 000 / GBP 800 000) × 100)]

The UK investor would be better off because the alternative is a GBP 800 000 investment in the UK at 9.6% pa.

It will be evident that the forward exchange rate in this example is *mispriced*. This mispricing creates an arbitrage opportunity and there will be a surge in demand for one-year forward contracts at the rate of GBP/USD 1.20. The surge in demand will ensure that the forward exchange rate will move rapidly in the direction of the covered interest parity (CIP) condition, i.e. at GBP/USD 1.23. At this level there are no riskless arbitrage profits to be made. It may be useful to go through this exercise again.

The rates are:

US one-year interest rate	= 8.0% pa
UK one-year interest rate	= 9.6% pa
Spot rate	= GBP/USD 1.25
1 year forward rate	= GBP/USD 1.23
Spot rate in 1 year's time	= GBP/USD 1.25

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A US investor buys a GBP 1 000 000 UK NCD (via a bank account balance created by the foreign exchange deal done):

Cost (at spot rate)	= USD 1 250 000 (1.25 × GBP 1 000 000)
Interest earned over year	= GBP 96 000 (0.096 × GBP 1 000 000)
Conversion of capital after 1 year	= USD 1 230 000 (1.23 × GBP 1 000 000)
Conversion of interest after 1 year	= USD 120 000 (1.25 × GBP 96 000)
Total converted into USD	= USD 1 350 000
Total earnings	= USD100 000 (USD 1 350 000 – USD 1 250 000)
Earnings in %	= 8.0% pa [(USD 100 000 / USD 1 250 000) × 100)]

The US investor is no better off investing in the UK. It will be apparent that the US investor gets back less capital (i.e. 2 cents less per GBP = USD 20 000), and this is because the rate of interest is higher in the UK by this differential. *Thus, the forward GBP must be at a discount to spot GBP.*

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2.7 Forward exchange market

The forward foreign exchange market operates in the much same way as the spot foreign exchange market. The market is OTC and the authorised dealing banks make this market. They quote bid and offer rates at all times in forwards for specific periods in months, and are always prepared to make a price for any periods in between, i.e. "custom make" forward contracts. Unlike the case of futures in the foreign exchange market, *forward contracts in most cases entail the delivery of the exchange on the expiry date of the contract* (foreign exchange futures are touched upon later).

In certain countries central banks at times "interfere" (they call it "intervene") in the forward market for specific reasons, the main one being to prop up the local currency (we assume LCC), i.e. to prevent the LCC from falling sharply at times. This usually brings about a situation where the country will build up a large exposure in the forward market, and the forward contracts have to be honoured as they mature. This means that the central bank has to supply foreign currency at rates agreed in the past (when the contracts were made). The chickens eventually "come home to roost" and large losses can be made (which are for the account of government).

Perhaps it will be useful to give an example of central bank interference in the forward market. We assume the following:

USD one-year interest rate	= 5.5% pa
LCC one-year interest rate	= 10.5% pa
Spot rate	= USD/LCC 10.20.

According to the *principle of covered interest rate parity*, the forward exchange rate in this case should be:

$$\begin{aligned}\text{Forward outright} &= \text{spot} \times [(1 + ir_{vc} \times d/365) / (1 + ir_{bc} \times d/365)] \\ &= 10.2 \times [(1 + 0.105 \times 365/365) / (1 + 0.055 \times 365/365)] \\ &= 10.2 \times 1.0439 \\ &= 10.6834.\end{aligned}$$

At any forward exchange rate of between USD/LCC 10.2 and USD/LCC 10.68, foreign investors can make riskless profits from an investment in the Local Country money market.

If, for example, the Local Country central bank provides forward cover for a year at USD/LCC 10.4, a US investor is able to buy a LCC 10 million one-year NCD, exit the investment after a year, sell the foreign exchange (LCC) for USD, and s/he would have bettered the domestic (US) rate of 5.5%. The following are the numbers, but before them is a reminder of the assumptions:

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USD 1-year interest rate	= 5.5% pa
LCC 1-year interest rate	= 10.5% pa
Spot rate	= USD/LCC 10.2
1 year forward rate	= USD/LCC 10.4 (i.e. rate quoted by central bank)
Spot rate in 1 year's time	= USD/LCC 10.4
Cost (at spot rate)	= USD 980 392.16 (1 / 10.2 × LCC 10 000 000)
Interest earned over year	= LCC 1 050 000 (0.105 × LCC 10 000 000)
Conversion of capital after 1 year	= USD 961 538.46 (1 / 10.4 × LCC 10 000 000)
Conversion of interest after 1 year	= USD 100 961.54 (1 / 10.4 × LCC 1 050 000)
Total converted into USD	= USD 1 062 500.00
Total earnings	= USD 82 107.84 (USD 1 062 500 – USD 980 392.16)
Earnings in % pa	= 8.375% pa [(USD 82 107.84 / USD 980 392.16) × 100]

Clearly, the US investor would profit handsomely by investing in Local Country – in terms of earning a better rate (8.375% pa) than the US rate of 5.5% pa.

The modus operandi of the central bank is to encourage forex inflows to the country via the cheap forward rate on foreign currency (in this example USD/LCC 10.4 instead of the market rate of USD/LCC 10.683, buy the USD (at spot rate) and use the USD to prop up the LCC by selling the USD spot into the local foreign exchange market.

As noted above, eventually the chickens come home to roost, and the international markets are not impressed with a large Net Open Forward Position (NOFP) balance.

2.8 Summary

The forward forex market has four products: outright forwards, swaps, time options and forward-forwards. The dominant one is the outright forward and it is a custom-made product. This product is a purchase or sale of forex (usually USD against the local currency) on a date on the future at a rate / price determined at the outset of the deal. Its Fair Value Price is the spot price enhanced by the time value of money, except that there are two interest rates involved: a local one and a foreign one.

The other three products are variations on the theme of the outright forward. The market is OTC and it is "made" by the banks, i.e. it is a quote-driven market.

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3 Derivatives: futures, options & swaps

3.1 Learning objectives

After studying this text the learner should / should be able to:

- Analyse and explain the derivatives of the forex market other than that already covered (forwards).
- Define and explain currency futures (futures on "physical" currencies and currency indices).
- Define and describe currency options (options on futures, options on currencies and options on currency swaps).
- Define currency swaps.

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3.2 Introduction

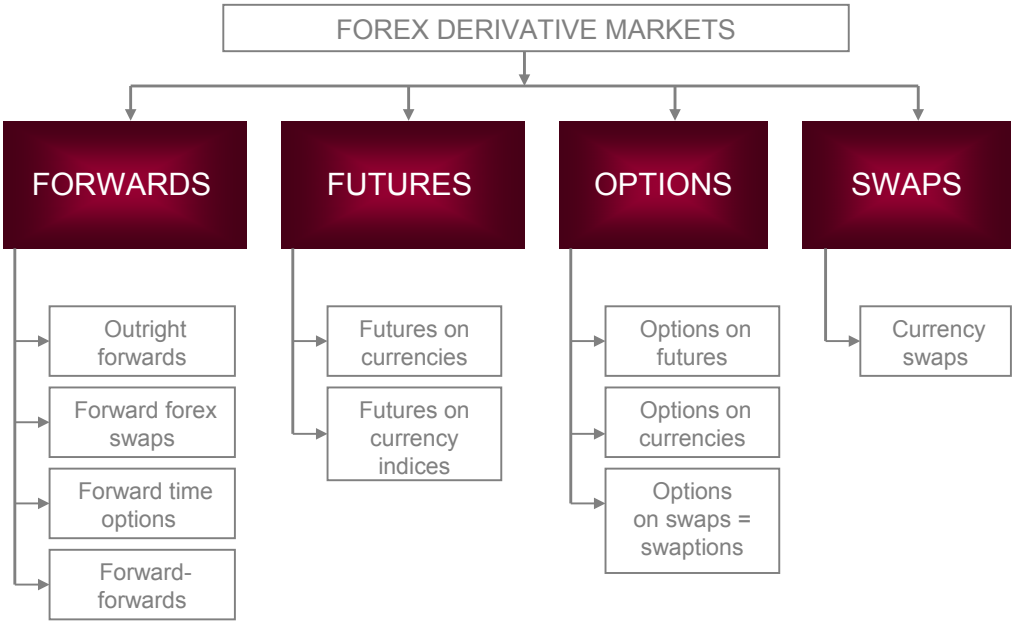

Figure 1: derivative instruments of the forex market

We have discussed the forex spot market as well as the forward market in some detail, because the forward market is intertwined with the spot market. It remains for us here to discuss the other derivative instruments of the forex market, as shown in Figure 1.

However, we discuss them only briefly here because they are covered in detail in a separate text. The following are the sections:

- Currency futures:
  - example of currency futures contract: general
  - example of currency futures contract: long
  - example of currency futures contract: short
  - valuation
  - concluding remarks.
- Currency options:
  - options on currency forwards
  - options on currency futures
  - options on currencies (currency "physicals")
  - options on swaps (swaptions).
- Currency swaps.

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3.3 Currency futures

3.3.1 Introduction

Currency futures or *foreign exchange futures* or *forex futures,* as they are also known, are a relatively new development in the foreign exchange markets. This instrument is similar to the currency forward, and yet there are significant differences. The currency forward, as seen earlier, amounts to the delivery (you deliver or are delivered to) of a specific currency on a specific date in the future at an exchange rate agreed upfront. The market is OTC and the risk inherent in the deal is between the buyer and the writer of the contract (bank).

In the case of currency futures contracts, the seller undertakes to sell to the buyer a currency on the future date at a rate agreed now. However, there is no intention to deliver the currency to the buyer. The market is formalised in an exchange and the two parties to a futures contract are "exposed" to the exchange rather than to one another, because the exchange interposes itself between the two parties and guarantees the deal (i.e. the two deals). In addition, the future is "tradeable", whereas the forward is hardly tradeable.

Figure 2: participants in futures deal

Other differences between futures and forwards are that futures are standardised in terms of size and date and have other specific characteristics, whereas forwards are often tailored to meet the needs of a specific client/s.

There are many futures exchanges around the world [examples are: the International Monetary Market, established by the Chicago Mercantile Exchange, the South African Futures Exchange (Safex – a division of the exchange, JSE Limited), the Philadelphia Options Exchange], and the variety of contracts is vast. The list of contracts shown in Table 1 is just an excerpt of the futures contracts that are listed on the various exchanges (from Wall Street Journal).

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Financial			Commodities	
Interest rate	Equity	Foreign currency	Agricultural	Metals and energy
Physical				
Treasury bonds Treasury notes Treasury bills Federal funds Canadian govt bond Eurodollar Euro mark Euro yen Eurobond	Various specific shares	Japanese yen Euro British pound Australian dollar Brazilian real Mexican peso Sterling/euro cross rate	**Grains and oilseeds** Wheat Soybeans Corn (maize) **Livestock and meat** Cattle – live Hogs – lean Pork bellies **Food and fibre** Cocoa Coffee Sugar Cotton Orange juice	**Metals** Gold Platinum Silver Copper Aluminium Palladium **Energy** Crude oil – light sweet Natural gas Brent crude Propane
Index (notional)				
Short sterling bond index Long sterling bond index Municipal bond index	DJ industrial S&P 500 NASDAQ 100 CAC-40 DAX-30 FTSE 100 Toronto 35 Nikkei 225	USD index		CRB index
Physical = the actual instrument, currency, commodity. Index = indices of exchanges, etc. CRB index = Commodity Research Bureau.				

Table 1: Examples of futures contracts

There are various contracts under each of these names, i.e. contracts that have different expiry dates, for example, 15 March, 16 June, 15 September, and 15 December.

The most popular currency futures contracts are for the future delivery (but are settled in cash) of USD, EUR, GBP, JPY, and CAD. It will be seen in Table 1 that there is also a future on a USD index. Thus, there are *two types of currency futures*:

- futures on currencies
- futures on currency indices.

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It may be useful to provide an example of a currency futures contract. In Local Country (LC) the futures and options exchange (LCFOX) is a division of the main exchange, LCEX. LCFOX has three currency futures listed:

- an USD/LCC contract
- a GBP/LCC contract
- an EUR/LCC contract.

These contracts enable LC individuals and companies to hedge against expected unfavourable movements in these currencies against the LCC (the exchange rates). The obvious question to ask at this stage is why have a listed currency futures market when a large and deep (i.e. efficient) forex forward market exists?

The answer is threefold: the forex forward market is a wholesale market made by the banks; it is also a marvellous market in that contracts are custom-made in terms of size; however, it has a major disadvantage in that it is not easy to unwind a forward contract.

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The listed currency futures market is designed to overcome the disadvantages of the forward market and to offer some advantages. The following are the major features of currency futures:

- It is a formalised exchange-driven market.
- A deal done is a deal in which the counterparty to you is the exchange.
- Contracts are standardised in terms of size and maturity ("close-out") dates.
- The contract size is small in order to allow the buyer / seller to virtually customise deal size (a substantial advantage of the forward forex market)
- A margin is paid to the exchange (via the broker-dealer, and interest is paid on the margin by the exchange).
- The deal can be terminated by effecting an equal and opposite deal to the one undertaken initially.

3.3.2 Example of currency futures contract: general

An example of a currency futures contract is required: see Table 2[19]. A reminder of a futures market: it allows one to buy or sell a standard quantity of a specific commodity or financial instrument (called the "underlying") in the future. In the case of a currency future the underlying is a financial "instrument" in the form of a specified spot rate exchange rate. In this case it is the rate of exchange between one unit of the USD (the base currency) and a number of LCC (the variable currency).

This future allows participants to:

- take a view on the movement of the LCC against the USD or
- hedge themselves against an anticipated change in the USD/ LCC exchange rate.

Specifications	USD/LCC
Code	LCCD
Underlying instrument	Rate of exchange between one USD and a number of LCC
Contract size	USD 1 000
Contract months	March, June, September, December
Expiry dates & times	12h00 on the Monday preceding the third Wednesday of each month (or previous business day)
Quotations	In LCC per USD to four decimals
Minimum price movement	0.0001 = LCC 0.1
Mark-to-market	Explicit daily; the forward value of the arithmetic average of the traded underlying spot taken for a 7-minute period between 16h25 and 16h30
Margining	As determined by the 2nd level LCEX portfolio scanning methodology
Expiry valuation method	Arithmetic average of the underlying spot rate / price taken every 60 seconds between 11h01 and 12h00
Settlement	Cash settled in LCC
Clearing house fees	Futures LCC 1.00 Options LCC 0.50

Table 2: Example of USD/LCC currency futures contract

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Participants are able to buy or sell the USD/LCC future. For example, if the participant:

- buys a USD/LCC future s/he is expecting the LCC to depreciate against the USD; s/he is said to be "long" of the future
- sells a USD/LCC future s/he is expecting the LCC to appreciate; s/he is said to be "short" of the future.

3.3.3 Example of currency futures contract: long

It should be evident that an individual who is travelling internationally in three months' time, and who expects the USD to appreciate against the LCC during this period (= more LCC per USD 1), will buy the future. S/he is hedging against a "natural short position" in the future (= sell LCC for USD). For example:

- if s/he requires USD 10 000 in three months' time (for a holiday),
- the spot exchange rate now is USD/ LCC 9.5,
- the futures price now is USD/LCC 9.6, and
- s/he expects the USD/LCC spot exchange rate to be at USD/LCC 10.0 in three months' time,

s/he will buy 10 futures contracts now at USD/LCC 9.6. If the view is correct and the USD/LCC exchange rate is USD/LCC 10.0 in three months' time, she will make a profit on the futures of (10.0 – 9.6) × USD 1 000 (= contract size) × 10 (= number of contracts) = 0.4 × 10 000 = USD 400 = LCC 4 000 (at USD/ LCC 10.0). This amount is paid to the participant and it reduces the cost of buying the USD 10 000.

Thus, s/he pays the spot rate of USD/LCC 10.0 for USD 10 000 and forks out LCC 100 000. The actual cost of course is LCC 100 000 – LCC 4 000 = LCC 96 000 (= USD 10 000 at the contracted exchange rate of USD/LCC 9.6). It will be evident that s/he fixed the cost of USD 10 000 three months ago at LCC 9.6 per USD 1.0.

The converse of the above will be apparent. If the USD/LCC spot exchange rate is recorded at USD/LCC 9.2 after three months (the LCC appreciates), the holder of the long contract (bought at USD/LCC 9.6) will make a loss on the future of LCC 4 000, but buy the USD 10 000 spot for LCC 92 000, for a total LCC cost of LCC 96 000.

If s/he expected the USD/LCC exchange rate to appreciate (to USD/LCC 9.2, i.e. less LCC per USD 1.0) s/he would have done nothing (i.e. not hedged). S/he would then have bought the USD 10 000 spot for LCC 92 000.

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3.3.4 Example of currency futures contract: short

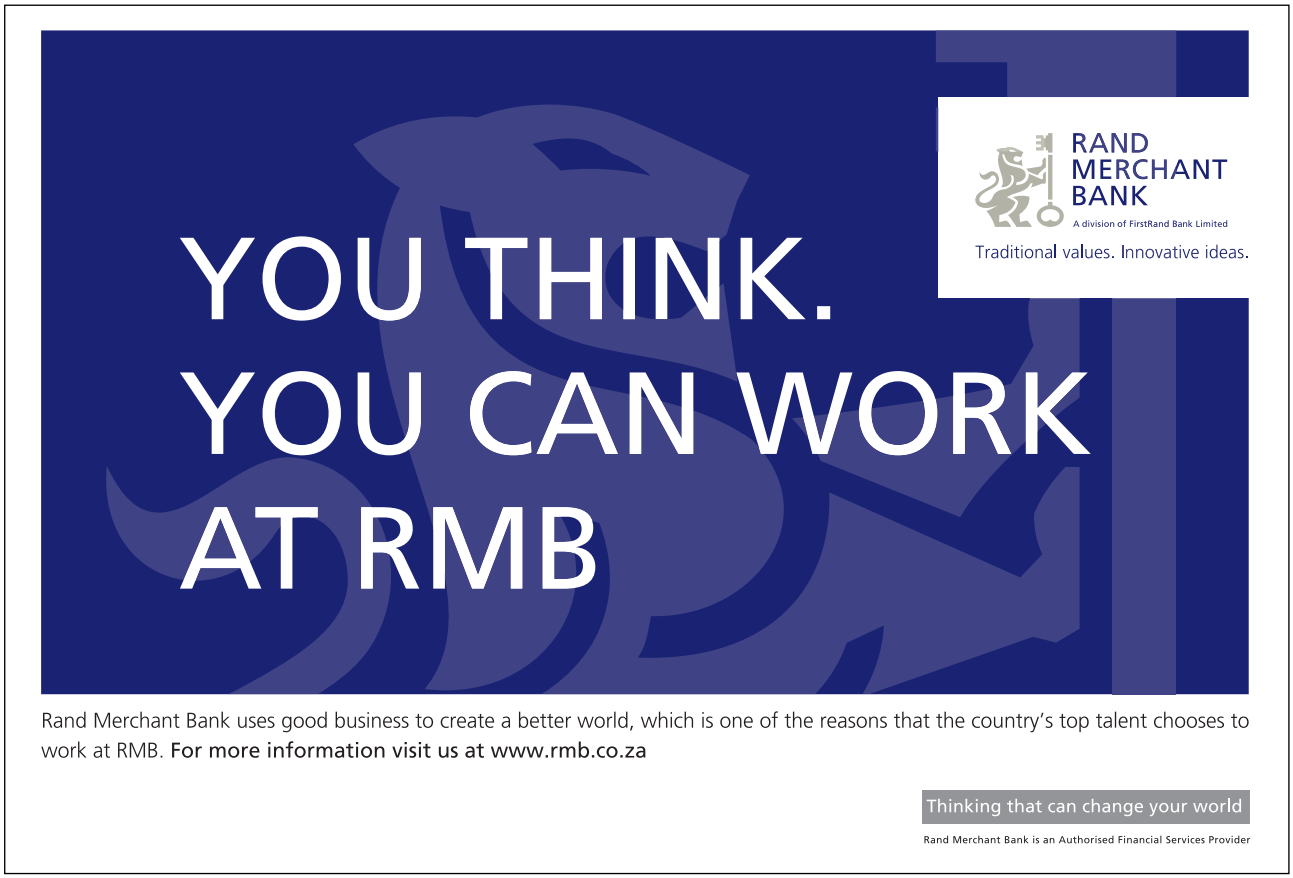
On the other hand, if a US citizen wants to holiday in LC in three months' time with USD 10 000, and s/he expects the USD to depreciate (to USD/LCC 9.2 = less LCC per USD), s/he will sell a currency future in LC. If the three month futures contract price is USD/LCC 9.6 and the view is correct, after three months s/he will make a profit of LCC 4 000. She will sell the USD 10 000 for LCC 92 000, but will have a total LCC amount of LCC 96 000.

If she thought the USD would appreciate (= more LCC per USD 1) she would do nothing.

3.3.5 Valuation

The valuation of forex futures means the computation of the Fair Value Price (FVP) of the future. This is the same as the computation of the FVP of outright forwards. A reminder:

$$\text{FVP (future)} = SP \times [(1 + ir_{vc} \times d/365) / (1 + ir_{bc} \times d/365)]$$



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where

SP = spot price / rate
ir_{vc} = interest rate on variable currency
ir_{bc} = interest rate on base currency
d = number of days.

This is the time value of money concept (PV-FV) in action, but with an important difference: there are two rates of interest involved: local and foreign.

3.3.6 Concluding remarks

In summary: a currency future enables one to:

- Hedge a natural position (such as an investment in foreign currency or a natural supply of / demand for forex).
- Speculate.

Both activities are founded on expectations of the exchange rate in the future.

Thus if one needs USD in the future (= a "natural short position") one has choices:

- Expect the LCC to depreciate against the USD: buy USD/ LCC futures
  - If correct: profit on futures offsets higher spot market cost of USD; total cost = price at which futures were bought.
  - If incorrect: loss on futures is compensated by paying less for USD in spot market; total cost = price at which futures were bought.
- Expect the LCC to appreciate against the USD: do nothing.
  - If correct: pay less LCC for USD than spot rate when the decision was made.
  - If incorrect: pay more LCC for USD than spot rate when the decision was made.

On the other hand, if one is expecting USD in the future [as in the case of a Local Country exporter (= a "natural long position")], the choices are:

- Expect the LCC to depreciate against the USD: do nothing.
  - If correct: earn more USD than spot rate when the decision was made.
  - If incorrect: earn less USD than spot rate when the decision was made.
- Expect the LCC to appreciate against the USD: sell USD/LCC futures.
  - If correct: loss made in spot market offset by profit on futures; total LCC price = price at which futures were sold.
  - If incorrect: loss on futures offset by paying less in spot market; total LCC price = price at which futures were sold.

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If one does not have a natural long or short position, and one buys or sells futures, one is speculating.

An interesting question arises: if one has a natural forex position and that position is not hedged, is this speculation?

3.4 Currency options

3.4.1 Introduction

The standard definition of an option contract is:

An option bestows upon the holder the right, but not the obligation, to buy or sell the underlying asset at a predetermined price during a specified period. Holders exercise their options only if it is rewarding to do so, and their potential profit is not fixed, while their potential loss is limited to the amount paid for the option, the premium.

There are two brands of options, i.e. American and European:

- An American option bestows the right upon the holder to exercise the option at any time before and on the expiry date of the option.
- A European option gives the holder to exercise the option only on the expiry date of the option.

The majority of options traded locally and internationally are American options. It is to be noted that the terms American and European do not refer to a geographic location. American options exist in Europe and European options can be found in America.

Options are classified as *call* options and *put* options:

- The *call* option bestows upon the purchaser the right to *buy* the underlying asset at the pre-specified price or rate from the writer of the option (think "call from the writer").
- The *put* option gives the holder the option to *sell* the underlying asset at the pre-specified price or rate to the writer (think "put the writer with…").

The buyer pays the writer of the option an amount of money called the *premium* (it is called this because an option is much like an insurance policy).

Thus, there are *two sides* to every option contract:

- The buyer who has taken a *long position*, i.e. s/he has *bought* the option and has the benefits of the option (the "option" to do something). The buyer pays the premium for the option.
- The seller who has taken a short position, i.e. s/he has *sold* the option and received the premium (the seller has "no options" but is contracted to do something if the buyer decides to exercise his/her option). The seller of an option is the writer of the option.

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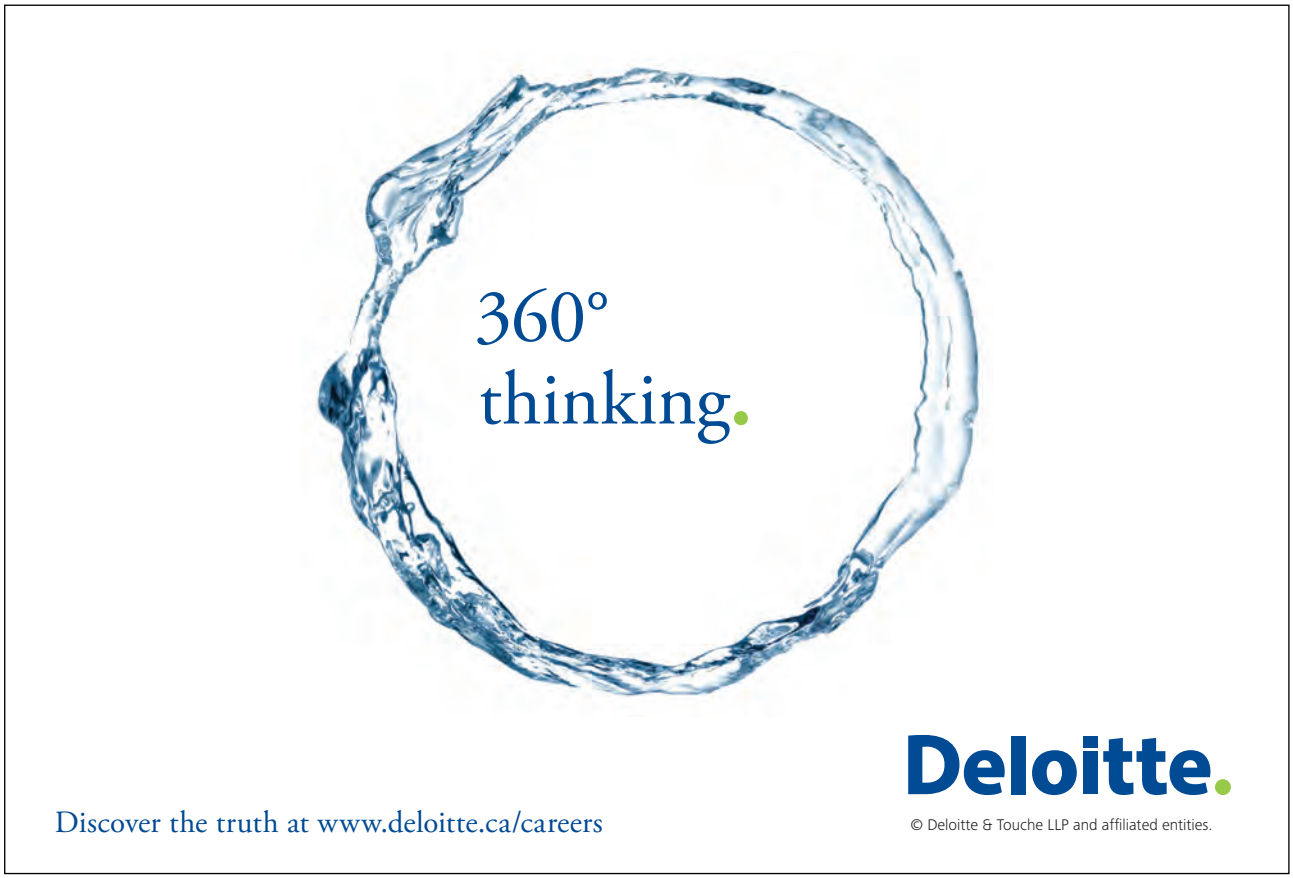
The options markets may be divided broadly into four categories:

- Options on futures
- Options on forwards
- Options on the "physicals"
- Options on swaps.

In the case of the currency markets, *options* are available and traded on:

- Currency forwards
- Currency futures
- Currency "physicals" (actual and index)
- Currency swaps.



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3.4.2 Options on currency forwards

In the case of most forward markets, there are few options to be found. This is because of the nature of the market, i.e. the informality of the market and the custom-made nature of the instruments. However, in the foreign exchange market the forward contracts are to a large degree standardised. For example, at any time a client would be offered quotations (by the banks) on forward contracts for 1 month, 2 months, 3 months, and so on up to longer than a year. Because of this, options are to be found on foreign exchange forwards.

Options on currency forwards and futures are not to be confused with *time options*. Here the holder has no "option" in respect of exercising; s/he is obliged to exercise but has flexibility as to when.

3.4.3 Options on currency futures

Taking the definition of options used above, a call option on a currency future gives the buyer the right but not the obligation to buy a specific future at a fixed price. The buyer thus locks in a desired currency delivery price (the word "delivery" is used although the contracts are settled in cash). Buyers of options on currency futures protect themselves against rising exchange rates.

A put option on a future gives the buyer the right but not the obligation to sell to the writer of the option a specified currency future at a fixed price (regardless of changes in the currency market). Buyers of puts on currency futures protect them against falling exchange rates.

Virtually all currency futures have options written on them. This makes them listed options. In some currency markets unlisted options on futures are also to be found, i.e. some traders are willing to write OTC options on futures.

An example of a listed currency option may be useful. On the LCFOX exchange there is a listed option with the code: SEP09 USD 10.62 CO. It is a September 2009 (= expiry date) USD/LCC call option at a rate / price of USD/LCC 10.62. The holder of the option has the right to buy one USD/LCC currency future at exchange rate USD/LCC 10.62 on or before the expiry date. The writer is obliged to deliver the currency future at this rate / price if the holder exercises the option.

3.4.4 Options on currencies (currency "physicals")

The word "physical" is used in the markets to distinguish options on derivatives (such as options on currency futures) from options on specific real underlying assets such as individual bonds and equities. The "physical" in the case of the currency markets is an exchange rate, i.e. the underlying "asset" is an exchange rate (which is not a derivative). We include options on indices under this heading.

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Examples of options on foreign exchange rates (also called currency options) that are traded are: CAD, EUR, AUD, GBP, and JPY.

3.4.5 Options on currency swaps (swaptions)

Options on currency swaps are also available in the major international foreign exchange markets. They are usually referred to as swaptions. Currency swaps are covered briefly below.

3.5 Currency swaps

A currency swap is not to be confused with a foreign exchange swap, which is a forward deal. A currency swap in its simplest form involves *the exchange of principal and interest payments in one currency for principal and interest payments in another currency*. The amounts involved are usually of equal magnitude. An example will be useful: see Figure 3[20].

Company A is a USD borrower, but after the borrowing of USD 15 million via the issue of 3-year bonds changes its view and prefers to be a borrower in GBP. The exchange rate is GBP / USD 1.5. Company B has the opposite situation. A smart broker discovers the altered views and new requirements of the two parties and arranges a currency swap as depicted. The swap transmutes Company A's USD borrowing at 8% pa into a GBP borrowing at 11% pa. Company B has the reverse situation.

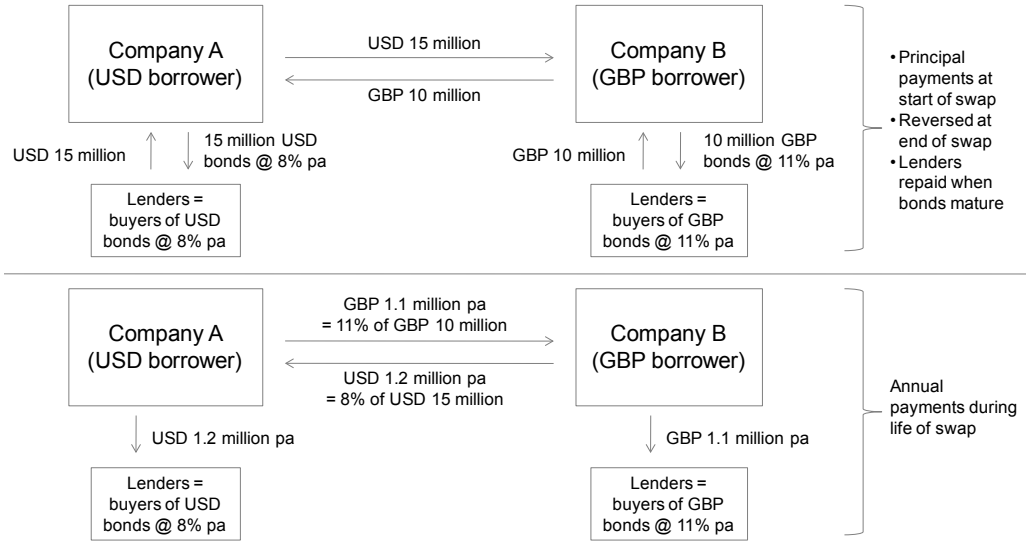

Figure 3: example of currency swap (transforming a liability)

It should be evident that a currency swap can also be used to transform an investment. For example if Company A is invested in a 3-year GBP investment, and changes its view in the direction of the USD strengthening against the GBP, it can undertake a currency swap that transmutes its investment into a 3-year USD investment.

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There are variations on the main theme of currency swap, but not as many as in the case of interest rate swaps. One of them is the *cross currency swap* (also called currency coupon swap). It involves the exchange of a floating rate in one currency for a fixed rate in another currency. This is essentially a hybrid of the simple currency swap and the plain vanilla interest rate swap.

Another is the *differential swap* (also termed the *diff swap*), which involves the exchange of a floating rate in the domestic currency for a floating rate in a foreign currency. Both payment s are referenced against a domestic notional amount.

3.6 Summary

The most significant forex derivative market is the forward market, specifically the outright forward market. The other forex derivative instruments are:

- Currency futures.
- Currency options:
  - options on currency forwards
  - options on currency futures
  - options on currencies (currency "physicals")
  - options on swaps (swaptions).
- Currency swaps.

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4 Risks other than currency risk & other risk management tools

4.1 Learning objectives

After studying this text the learner should / should be able to:

- Elucidate the risks other than exchange rate risks in international trade and finance.
- Analyse these other risks: transactions costs, settlement risk, taxation, market size and its effect on liquidity, availability and reliability of information, valuation of markets, trading methods.
- Appreciate and describe the other risk management tools employed in the foreign exchange markets.
- Explain the mechanics of these alternative risk management tools: currency risk insurance, utilisation of local loans, dual-currency bonds, prepayment for exports, barter, selective currency pricing, risk-adjusted pricing and "leads and lags".

4.2 Introduction

We have covered the risk hazards of changing exchange rates, the currency risk attached to investing offshore and the methods employed to reduce this risk (i.e. forex derivatives and hedging methods). It is obvious that currency changes can easily more than wipe out superior returns earned in the financial markets in foreign countries.

In addition to the currency risk faced by offshore investors, they also face the same financial risks in countries as do the domestic investors (such as credit risk, counterparty risk, liquidity risk, market risk, and so on). This brief text covers these financial risks, as well as the other more obscure risks, from the perspective of foreign investors. They are:

- Interest rate risk.
- Market risk.
- Credit risk.
- Transactions costs.
- Settlement risk.
- Market size.
- Availability and reliability of information.
- Valuation of markets.
- Trading methods.

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There are also a number of other less well-known risk management tools[21] employed by participants in the foreign exchange markets. They are:

- Currency risk insurance.
- Utilisation of local loans.
- Dual-currency bonds.
- Prepayments for exports.
- Barter.
- Selective currency pricing.
- Risk-adjusted pricing.
- "Leads and lags".

4.3 Risks other than currency risk in investments

4.3.1 Introduction

As we have seen, there are other risks involved in foreign investing:

- Interest rate risk.
- Market risk.
- Credit risk.
- Transactions costs.
- Settlement risk.
- Market size.
- Availability and reliability of information.
- Valuation of markets.
- Trading methods.

4.3.2 Interest rate risk

Interest rate risk (IRR) is different for banks compared with non-bank investors. For banks there are two elements that make up IRR:

- the margin between the rates earned on assets and paid on liabilities
- the repricing dates of assets and liabilities at different points in time (resulting in mismatches in the various time bands, for example 0–30 days, 30–60 days, 60–90 days and so on).

IRR for non–bank investors applies only to a floating rate investment, and it is the risk that the rate of interest will move down. It will be evident that this risk essentially is an earning opportunity lost when rates increase (called an *opportunity cost*). When this is applied to a fixed rate investment, it is market risk, which is covered next.

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4.3.3 Market risk

Market risk is the risk that the market price of an asset could change, and it applies to fixed rate investments and ordinary shares (equities). When applied to ordinary shares it is simply the risk that shares prices can fall. When applied to fixed rate investments (like bonds and preference shares) it is the risk that the market rates on these investments rise, casing the prices to fall.

4.3.4 Credit risk

Credit risk is the risk that the issuer of the investment (equity or bond) will default on the instrument and/or the interest / dividend payable, i.e. that it will not perform as expected.

4.3.5 Transactions costs

"Transaction costs" refers to the commissions, fees and other costs (see below) associated with investing in foreign financial markets. Transactions costs vary substantially between markets. Local Country (LC) investors are used to specific and low transactions costs because the local financial markets are sophisticated and well supervised. However, this is not necessarily the case in other countries.

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Transaction costs include:

- Commissions of broker-dealers in order-driven markets.
- Spreads in quote-driven markets.
- Taxes based on the value of deals.
- Withholding taxes.
- Capital gains tax.

4.3.6 Settlement risk

The developed economies, and many developing countries, such as LC, have sophisticated (formalised and OTC) financial markets, and part of the formalised and OTC market structures is fixed settlement periods which are adhered to without exception.

The settlement periods vary from T+0 to T+5. The money market usually settles on T+0 (= the day the transaction / deal is done) or T+1 (= the first business day after the transaction is done), while T+5 (= 5 business days after the deal is struck) is usually the settlement time for the equity market. In between are the other markets, such as the forex market which settles on T+2, and the bond market which settles on T+3.

In all countries the settlement dates are set by convention, but settlement is often delayed in some countries. This market-miscreant creates serious administrative problems and can affect returns. It can also engender the need for superfluous personnel and higher transaction costs.

4.3.7 Market size

The size of the foreign market in is an important consideration in investments, and there are three issues in this regard:

- The number of companies listed.
- Liquidity in the market and in individual shares.
- Number of shares issued by individual companies.

A perceived good investment in the shares of a company listed on a foreign exchange may end up being a poor investment because the market price may be under- or over valued – as a result of the market being an illiquid market (permanently or at times). This problem may be exacerbated by a limited number of shares in issue. A USD 20 million deal on the New York Stock Exchange may be a small deal, but it will constitute a large deal on many foreign exchanges, and may move prices dramatically away from fair value.

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4.3.8 Availability and reliability of information

The ready availability and reliability of information on markets, segments of markets, individual companies, etc, was taken for granted in certain of the developed markets, but this became a delusion with the high profile collapses of certain large commercial companies, banks and insurers in 2001–2008.

In some "sophisticated" financial markets, certain large companies reported inflated profits, and certain banks and insurers undertook large positions in derivative securities without proper assessment of the risks. Some of them were declared bankrupt and some were absorbed into certain other entities.

The causes were many, including promiscuous monetary policy (leading to unsustainable booms) poor supervision, and poor assessment of risk not only by the entities themselves but also by certain rating agencies. The dust was settling at the close of 2008.

One is inclined to state that the ready availability and reliability of information on markets, segments of markets, and individual companies, and so on is poor in certain developing countries, but now we know that this is not restricted to them.

However, this does not detract from the reality that in many of the smaller markets there are not standardised methods of reporting or accounting. Also, economic information is not always reliable and readily available. This constitutes risk.

4.3.9 Valuation of markets

There are many company valuation methods; see Figure 1. These are sophisticated and rely on sophisticated information. Apart from market problems such as liquidity impacting on valuation, other valuation problems can exist such as ratios not always being comparable between countries because of differences in reporting and accounting methods.

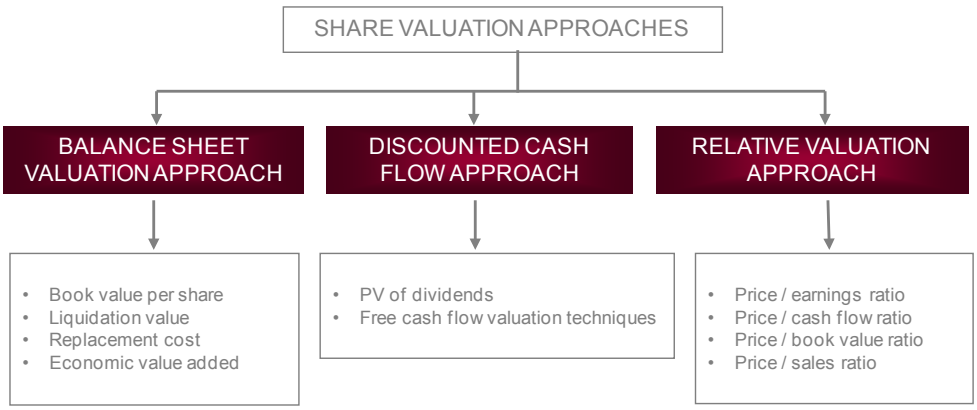

Figure 1: approaches to share valuation

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4.3.10 Trading methods

There are different trading methods between countries that may involve a foreign investment in more risk than in the markets of the home country. For example, the risk of scrip fraud may exist in certain foreign markets; there may be counterparty risk in an OTC market compared with a formalised market.

4.4 Other risk mangement tools

4.4.1 Introduction

There are a number of other less well-known risk management tools[22] employed by participants in the foreign exchange markets. They are:

- Currency risk insurance.
- Utilisation of local loans.
- Dual-currency bonds.
- Prepayments for exports.
- Barter.
- Selective currency pricing.
- Risk-adjusted pricing.
- "Leads and lags".

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4.4.2 Currency risk insurance

Currency (or exchange risk) insurance is available in certain instances from domestic government and multilateral organisations, and from certain private insurers. The USA Export-Import Bank and the World Bank group are examples of non-private organisations that offer international insurance products.

The motivation for providing currency risk insurance in the case of private insurers is obviously profit, while in the case of non-private organisations it is the promotion of trade in undeveloped countries.

4.4.3 Utilisation of local loans

Utilisation of local loans means the accessing by multinational companies of loans in the countries in which they do business for the financing of sales and/or the setting up of production infrastructure.

An example would be the setting up of production facilities by a UK company in Local Country (LC) for the production of goods to be sold in LC. The company has no exchange risk on the capital investment, and is able to transfer profits freely into the currency of the home country.

The utilisation of local loans also applies to the investment markets. For example, a foreign bank is able to invest in the local bond market by having the bonds "carried' (i.e. sold under repo) locally for the period of the investment. This means that bonds are purchased outright and sold immediately under repo for the desired holding period. At expiry of the repo period, the bonds are sold outright (or sold again under repo). Profits are repatriated in the currency of the home country. There is no exchange risk involved in the deal. Clearly, only market risk exists.

4.4.4 Dual-currency bonds

Dual-currency bonds are also utilised by certain companies. This type of bond is one where the principal is payable in one currency and the interest payments in another.

4.4.5 Prepayment for exports

Companies are able to avoid currency risk by exporting goods to a foreign country on the condition that payment is made at the time of shipment in the currency of the exporter's country.

4.4.6 Barter

Barter (also called *counter-trade*) is not uncommon. It is the exchange of goods so that no currency changes hands. An example is the sale of maize by a LC company to Zimbabwe in exchange for wheat, which is then sold locally.

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On a national level, many countries have counter-trade transactions as a precondition for a large import deal. While this is not a direct risk management tool, it does play a substantive role. A good example is the substantial arms deal that LC undertook recently (importation of frigates, aircraft, etc). The deal was so large that it would have affected the LCC's value against all other currencies. The counter trade obligations offset the effect on the local currency.

Another example of counter-trade obligations is USA cola producing company, PepsiCo, which has production facilities and a large market for its cola brand in India. PepsiCo is obliged, as a countermeasure to its requirement for USD (to distribute profits to its parent), to undertake the large-scale export of products from India. It discharges this obligation by the development and production in India of a brand of basmati rice (Seasons Harvest), which is widely exported product from India.[23]

Quite often barter trade takes place because foreign exchange is just not available. For example in Zimbabwe in 2002–09 when the ZWD depreciated substantially against the backdrop of land invasions, blossoming budget deficits, wholesale printing of money (of the physical variety and via the banking system), the consequence was increasing inflation, and forex was just not available. It was not available because exporters held on to it for dear life (because the currency was pegged, it is an economically rational response, and because exporters' input costs were often not subject to currency controls), Zimbabwe was forced to resort to exchange the "family jewels" (in the form of shares in various state enterprises) for fuel, oil and electricity from certain countries.

There are two terms in barter (counter-trade) that require mentioning: *offset arrangements* and *counter-purchases*. *Offset arrangements* are where the goods to be exchanged are identified in advance but the exchange of the goods occur on different dates. *Counter-purchases* are where the goods are not identified in advance and the exchange takes place at different times (which is obvious).

4.4.7 Selective currency pricing

Selective currency pricing is the invoicing by a local company of a foreign company in a third currency that is thought to be more stable. For example, a LC company that is concerned about the future value of the LCC and the Zimbabwe dollar can sell wheat to a Zimbabwean miller and invoice the Zimbabwean miller in USD.

4.4.8 Risk-adjusted pricing

Risk-adjusted pricing is the raising of the prices for goods exported to a country with a volatile currency. The exporter demands higher prices to compensate for the high level of currency risk.

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4.4.9 "Leads and lags"

The "lead" in "leads and lags" means leading payment for imports in foreign currency and "lags" means lagging repatriation of foreign currency earned from exporting. For example, if a LC importer is of the strong opinion that the local currency (LCC) is about to depreciate in relation to the currency in which the imports are denominated (say USD), s/he will pay for the imports in USD as quickly as possible (in order that the price in LCC terms will not increase). In other words, the importer will "lead" payment.

A LC exporter of goods denominated in USD, with the same expectation as above, will keep the export proceeds in USD offshore for as long as possible (to earn more LCC later). In other words the exporter will "lag" repatriation of the USD export proceeds.

It will be clear that when the expectation is as above, the supply of USD into the local market will fall for a period. Speculators will exacerbate the demand / supply condition (by buying USD for LCC and holding on to them for as long as the bearish expectation exists), as with other participants (such as investors) in the market. The expectation generally becomes self-fulfilling.

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4.5 Summary

There are numerous risks other than currency risk in investing offshore:

- Interest rate risk.
- Market risk.
- Credit risk.
- Transactions costs.
- Settlement risk.
- Market size.
- Availability and reliability of information.
- Valuation of markets.
- Trading methods.

There are a number of risk mitigation tools other that use of the forex derivative markets:

- Currency risk insurance.
- Utilisation of local loans.
- Dual-currency bonds.
- Prepayment for exports.
- Barter.
- Selective currency pricing.
- Risk-adjusted pricing.
- "Leads and lags".

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5 Participants

5.1 Learning objectives

After studying this text the learner should / should be able to:

- Define all the participants in the foreign exchange market.
- Analyse the role of each of the participants: authorised dealer banks, foreign exchange brokers, central bank, government, retail clients, non-bank dealers in foreign exchange, corporate sector, arbitrageurs and speculators.

5.2 Introduction

There are a number of participants in the foreign exchange market, including banks, individuals, companies, the central bank, investors, speculators, etc. They are best identified in a depiction of the financial system (see Figure 1).

To these participants of the financial system that all in one way or another use the foreign exchange market must be added the *foreign exchange brokers*. They do not form part of the financial system depiction because they do not act as principals. In fact they are the "purest" form of broker, as will be discussed in full later.

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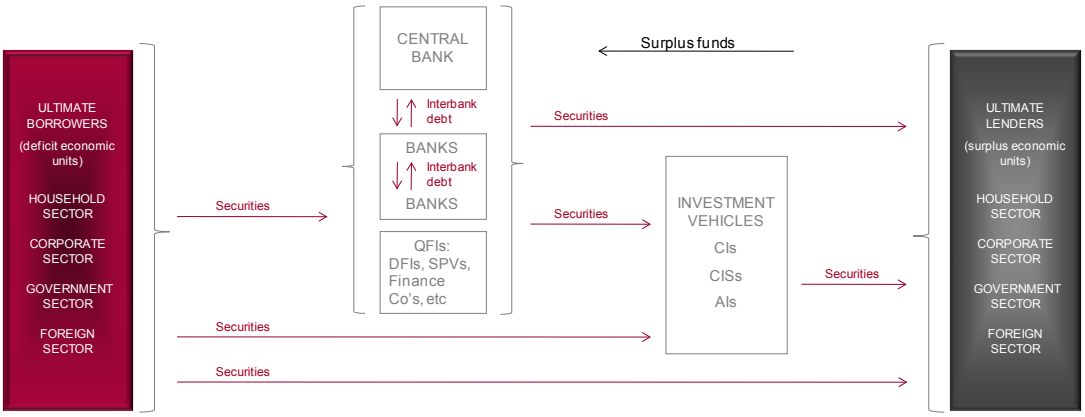

Figure 1: relationship of financial intermediaries

Another logical categorisation is a differentiation between the market makers (the banks, and the central bank to a degree), the foreign exchange brokers and the rest, which may be seen as clients of the market makers. The participants may thus be depicted as in Figure 2.

It may be seen in the above classification that the central bank and the authorised dealer banks are given prominence. This is because they play the major roles in the market. Government deals only with the central bank in most countries. The foreign exchange brokers have a relationship only with the authorised dealers (and in some cases with the central bank). The authorised dealers deal with (apart from the aforementioned) their foreign bank counterparts and with their "other" clients.

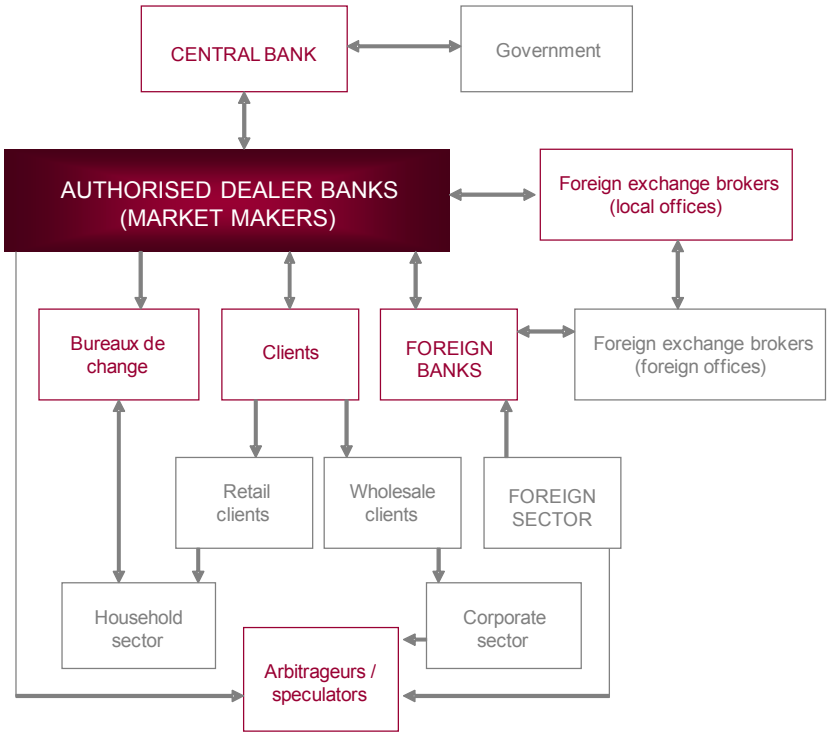

Figure 2: participants of the foreign exchange market

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The banks' "other" clients may be split into retail and wholesale clients. The corporate sector is generally seen as a wholesale client, while the household sector is largely (not exclusively) a retail client. The arbitrageurs and the speculators in the foreign exchange market are the banks themselves, the foreign sector (but via the foreign banks) and certain members of the household and corporate sectors.

The roles of the various participants in the foreign exchange market are outlined below, in the following order:

- Authorised dealer banks.
- Foreign exchange brokers.
- Foreign banks.
- Central bank.
- Government.
- Retail clients.
- Non-bank authorised dealers.
- Corporate sector.
- Arbitrageurs.
- Speculators.

5.3 Authorised dealer banks

As the market makers, the authorised dealer banks are the most important players in the forex market. In most countries they are authorised by the Finance Department (Treasury) (via the central bank) to deal in foreign exchange, and they make a market in foreign exchange by being prepared at all times to quote buying and selling rates in the forex spot and forex forward markets.

Figure 3 depicts the role of the market maker, the essence of which is that any other wholesale participant can at any time get a bid / offer quote from the banks. The bid / offer quote is deal-size dependent, and the client can deal on any side of the quote (i.e. accept the bid or the offer).

The spread is the differential between the bid and offer rates and is an indicator of the liquidity of the market at the time the quote is made. The size of the spread is inversely related to the liquidity of the market.

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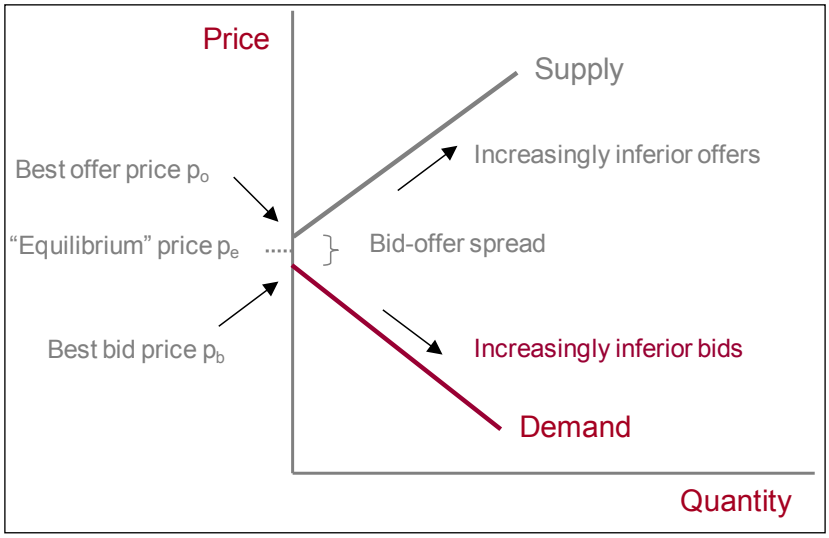

Figure 3: bid and offer prices and spread

In most countries the banks deal extensively with the central bank, rarely between themselves (which is where the foreign exchange brokers enter the picture – see next section), their overseas correspondent banks and other banks, and they deal with their other clients (which may be spilt into retail and wholesale clients – covered later).

In conclusion: the authorised dealer banks are the very core of the spot and forward forex markets.

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5.4 Foreign exchange brokers

5.4.1 Introduction

Foreign exchange brokers are to be found in all the major foreign exchange markets and in some of the smaller markets. Local Country (LC) has three.

The role of the brokers is to quote to the dealing banks bid and offer rates on a continuous basis, via so-called "squawk boxes". This communication system is made up of open telephone lines between the brokers and the dealing banks and the quotes are "shouted" across the line to speakers in the dealing rooms in real time. A handset or microphone allows the bank to communicate with the broker. The quotes are obtained from the local dealing banks and the foreign dealing banks, which are forthcoming via the brokers' international offices. A dealing bank wishing to deal with a broker simply lifts the handset part or the microphone of the communications system of the relevant broker, asks about the volume (size available), and deals on one or both side/s when propitious.

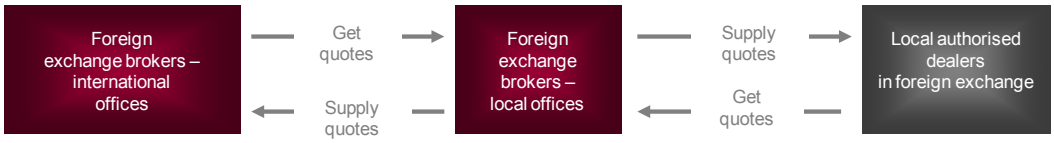

Figure 3: role of forex brokers

The quotes communicated to the banks are firm and two-way, and are made in the local currency per USD and in other international currencies against the USD. The latter are mainly USD per GBP, USD per EUR, and so on. The quotes are for immediate settlement (i.e. spot for settlement on T+2) and for forward dates. The brokers offer a valuable service, in that the rates quoted are the best available and information on the state of the markets is communicated "live".

The local banks execute the majority of their deals via the brokers because the brokers offer them anonymity at the time of the deal. There are two types of brokers: the smaller brokers that disclose the two dealing parties to one another and settlement takes place between the two parties (the "name-give-up" brokers), and the larger brokers with which the two parties settle (the "principal" brokers). The brokers receive a fixed fee, i.e. do not take a "turn" on the banks.

Most banks have dealing limits with other counterparties, but the limits are large, the risk to them being settlement risk. Thus, the risk lies therein that the counterparty is unable to settle, in which case the dealing bank has to do a deal with another counterparty at a rate that differs from that rate concluded with the reneging counterparty. The rate may be better (in which case an unintended profit is made) or worse (in which case an unintended loss is made). There could also be a date mismatch, because the reneging party will probably renege on settlement date which of course is T+2. Clearly, the new deal undertaken by the bank (to fulfil the original deal) will only be settled two days later.

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In the event that the dealing limit with a counterpart bank is full, which is known when the two parties to a deal are disclosed (in the case of the smaller brokers that "give up" the names"), the broker will arrange that the deal is done, but with another party with which the relevant bank still has an unused limit.

5.4.2 Approval by central bank and other conditions

The monetary authorities of the countries where they are established usually approve the foreign exchange brokers [i.e. the Finance Department (Treasury), the central bank or the central bank on behalf of the Treasury approves them]. The relevant authority usually sets down certain conditions for their operation, and these include:

- They must be incorporated companies, and must comply with a minimum capital requirement.
- They must be independent of any authorised dealer in foreign exchange.
- They may not buy or sell foreign exchange for own account and may not borrow or lend foreign exchange.
- At least one party to every deal done with a foreign exchange broker must be with an authorised dealer in foreign exchange.
- They are obliged to comply with a code of conduct, the objective of which is to ensure high ethical standards, quality of service and competition in the market.
- The relevant authority reserves the right to lay down maximum fees charged by brokers.
- They are obliged to report to the central bank on their activities on a regular basis. The frequency and the type of information required differ from country to country.

Two final points of interest need to be mentioned. It was noted above that one of the conditions is "At least one party to every deal done with a foreign exchange broker must be with an authorised dealer in foreign exchange". This means that the brokers may deal between an authorised dealer on the one hand and with a "client" (say a company) on the other. Although this is the case, this never happens, and the reason is that there is an undocumented understanding that the banks will deal with the brokers only on condition that the brokers do not deal with their clients. The brokers "see" most of the deals in any case, and value the business of the banks; consequently they do not tread on the sacred turf of the banks.

It was noted above that the brokers must comply with a minimum capital requirement. The requirement is not onerous and this is because the brokers are not principals to the deals done, as described above. However, at times, as a result of human error, there are misquotes, and the broker is obliged to make good the difference between the quote communicated and the market rate dealt at to fulfil the deal.

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5.5 Foreign banks

Foreign banks are involved in the local foreign exchange markets of the world in three main ways:

- Counterparts of dealings of local banks.
- Holders of accounts of local authorised dealers in foreign exchange.
- Investors / speculators in the local market

As noted above *ad nauseum*, the large banks dominate the foreign exchange markets of the world. When a foreign exchange deal is done this ends up as a deposit or the withdrawal of a deposit at a foreign bank. Foreign banks are thus the counterparts of all foreign exchange deals.

Dealers in foreign exchange hold portfolios of foreign exchange. As noted, foreign exchange is normally defined as balances on deposit accounts at foreign banks. Investments in other foreign securities are the next step from a deposit.

Foreign banks are participants in the local foreign exchange market from an investment/speculation point of view, and it is mainly the international investment banks that invest/speculate in foreign markets. The first step in the process is the buying of foreign exchange, i.e. a deposit at a bank, followed by the investment (if this is desired) in foreign securities.

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5.6 Central bank[24]

5.6.1 Introduction

The central bank is a significant participant in the foreign exchange market, and it participates in a number of ways that may be categorised as follows:

- Buyer and seller of foreign exchange.
- Manager of the gold and foreign exchange reserves of the country.
- Administrator of exchange controls (in some countries).

These functions are detailed below.

5.6.2 Buyer and seller of foreign exchange

The Local Country central bank (LC CB) is a buyer and seller of foreign exchange from time to time. It explains:

"The exchange rate of the LCC is basically determined by market forces. For instance, buying and selling rates for USD quoted by authorised foreign exchange dealers are based on the supply of and demand for dollars in the market at any given time. The LC CB may, in line with prevailing monetary and exchange rate policy, intervene in the market from time to time by purchasing or selling dollars. When intervening in the market, the CB does not attempt to bring about any structural change in the economy or to affect longer-term movements in balance of payments transactions; it merely intervenes to smooth out unduly large short-term fluctuations in the money market liquidity or in the exchange rate. During 1996, for example, the LC CB intervened quite heavily in the foreign exchange market by supplying the market with a substantial amount of dollars when the large demand for foreign exchange threatened to disrupt the market and cause an unwarranted depreciation of the LCC."

From this quote it will be apparent that the LC CB does not intervene in the market on a continuous basis. It does so at times "…merely…to smooth out unduly large short-term fluctuations in the money market liquidity or in the exchange rate." The latter activity of the CB is self-explanatory. However, its action in the foreign exchange market to smooth large short-term fluctuations in the money market liquidity is not immediately clear.

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What is meant in this respect is that the CB at times does foreign exchange swaps with the local banks. It swaps USD for LCC and simultaneously reverses the deal for a future date taking into account the forward points. This essentially means it sells USD to the private sector banks (specifically the authorised dealers) under repurchase agreement in order to reduce money market liquidity, i.e. to increase the "money market shortage" (MMS). This usually takes place when the CB itself has purchased foreign exchange to bolster its reserves (and created LCC). It may also do so when it does not bolster its foreign exchange reserves. It may also unwind part of these swaps at times also to influence liquidity. As noted, these deals with the banks are called foreign exchange swaps.

The details of the LC CB's actions in the foreign exchange market in order to influence money market liquidity and the money stock are dealt with in a later text.

5.6.3 Manager of the gold and foreign exchange reserves of the country

5.6.3.1 Introduction

One of the functions of the LC CB is to act as custodian of the "official" gold and foreign exchange reserves of the country. By this is meant that, because government owns the central bank, the foreign exchange reserves and gold holdings of the CB are held on behalf of the government (i.e. the citizens) of the country. The level of reserves is an important indicator of the "health" of the balance of payments, and is monitored by foreign investors. Central banks usually endeavour to maintain reserves equal to at least the value of three months of imports.

In respect of foreign exchange and gold holdings, the most qualified commentator is the LC CB. The LC CB's views in this respect follow.[25]

5.6.3.2 Why do central banks hold foreign exchange reserves?

Central banks are thought to hold reserves, assets denominated in foreign currency, for three reasons, not unlike the reasons why individuals hold money.

- To be able to intervene, i.e. buy or sell foreign exchange in the foreign exchange market to influence the value of the currency, the central bank requires a stock of foreign exchange.
- Central banks may also hold foreign reserves for transaction purposes, for example to finance foreseeable foreign exchange demands from the public sector – the government could wish to repay a maturing foreign loan.
- The third reason for holding foreign reserves relates to the portfolio or wealth diversification motive. Most central banks consider safety, liquidity and return, arranged in order of importance, as their major reserve management guidelines. Wealth considerations influence decisions on the composition of reserves and, to a lesser extent, the desired level of reserves. It is worth noting that countries usually diversify their currency portfolio into USD, EUR, GBP, JPY and SHF. Gold is often held also for reasons of diversification and because it is no one's liability.

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In conclusion, it should be noted that an adequate level of reserves is required for almost every country that seeks to employ the savings of other nations to develop its own economy. It is ironic but true that a small country needs foreign reserves earned through its own productive efforts and accumulated through its own virtuous savings before it will gain access to the savings of other countries.

5.6.3.3 The desired level of reserves

When the Bretton Woods system broke down in the early 1970s, essentially a system under which exchange rates were fixed, countries moved towards more flexible exchange rates and it was anticipated that foreign reserve requirements would be reduced. This has not proved to be the case as *many countries have still chosen to intervene in the foreign exchange market*, and the *increase in exchange rate volatility, moreover, has encouraged countries to hold yet more reserves.* (A higher level of reserves is thought to enhance the credibility of the central bank's exchange rate policy.)

Other factors (also) influence the appropriate level of reserves. These factors include the openness of the economy, as measured by the ratio of the value of foreign trade to the level of Gross Domestic Product (the total value of final goods and services produced in a country during a year), the flexibility of the economy to adjust to changes in foreign trade and international capital flows, trade and capital market restrictions, and the cost of holding reserves.

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As a rule of thumb, a guideline for an adequate level of reserves is the level which equals the value of three months' imports into the country concerned.

5.6.3.4 Brief overview of reserve management

Management of the official reserves of a country is similar to the way a prudent individual would manage a portfolio of foreign assets. Consideration has to be given to the appropriate composition of the reserves – decisions have to be taken regarding the currency denomination, the type of instrument and the maturity profile of foreign currency assets. For example, should GBP 3-month treasury bills be preferred to USD 10-year treasury bonds?

The process of reserve management therefore has many ingredients, including specifically the description of sub-portfolios in which foreign exchange is invested, the definition of clearly defined objectives for these portfolios, the establishment of limits, controls, reporting and the evaluation of foreign currency investment performance in terms of agreed benchmarks, for example the yield on 90-day USD treasury bills.

An essential ingredient of this process is a *management information system* measuring exposures to liquidity, interest rate, exchange rate and credit risks and ensuring that such risks are managed. Performance must obviously also be measured. Almost none of the major central banks of the world put all their reserves out to management by an outside manager. Of those which do use outside managers, the major share of their funds is still managed by the central banks themselves. This suggests that the benefits from in-house management of reserves, including questions of security, confidentiality, simplicity and costs, as well as development of staff, are substantial.

5.6.3.5 Reserve management in Local Country

The LC monetary authorities have from time to time endorsed the traditional view that the country should maintain gold and other foreign assets at a level at least equal to three months' imports, as this is deemed prudent and will add credibility to exchange rate policy. In the adverse conditions of the past, when not only the terms of trade and trends in international capital flows moved against developing countries, but internal and external political actions also buffeted the balance of payments, this proved an unattainable target.

For most of the time, the country has had to contend with a very low level of reserves, and consequently reserve management focused on the required degree of liquidity and safety of these reserves. The LC CB has negotiated bilateral short-term standby loan facilities as well as a syndicated loan facility with its overseas correspondent banks, which may be drawn down to supplement the official gross reserves.

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5.6.3.6 Composition of gold and foreign exchange reserves

In recent years the country's gold and foreign exchange reserves have improved. In particular, the official reserves held by the CB have grown so much that reserve management has had to be conducted, also with a view to acquiring a satisfactory return within acceptable risk parameters. That is, a portion of the CB's foreign exchange reserves is more actively managed within strict guidelines to achieve this goal – a portion of these reserves is also managed by external fund managers.

Most of the LC CB's foreign exchange reserves are still held in very liquid form. This implies that most of the foreign exchange reserves are held in investments with the Bank for International Settlements and in fixed, overnight, current and call deposits with approved counterparties. Most of these foreign assets are denominated in USD.

5.6.3.7 Management of foreign exchange reserves

The *relative importance of dollars in foreign exchange holdings* can be ascribed to a number of factors:

- The foremost factor is the role of the dollar as an international reserve currency offering a wide range of market instruments and deep markets in which large transactions may be readily executed.
- Secondly, a large part of LC's exports as well as imports are denominated in USD.
- Thirdly, dollar-denominated commitments form a substantial proportion of the country's external debt.
- Fourthly, dollars are used almost exclusively in spot (for value date two business days after the deal date) and to a considerable extent in forward (where the future value date and rate are agreed to by the counterparties) transactions between the CB and the banks authorised to deal in foreign exchange.
- Finally, the LC CB has certain contingent liabilities denominated mainly in USD.

As mentioned, decisions are called for on the appropriate composition of the reserves. Matters such as return versus liquidity, risk versus safety, owned reserves versus borrowed reserves and the currency composition of the official reserves must continuously be considered by the managers of the reserves. For most of these decisions no general rules are available, and the discretion of the central bank in these matters is decisive.

The prudent management of reserves involves a thorough understanding of the instruments in which the central bank might invest, including the probable future values of such assets, and a thorough understanding of the inevitable risks which flow from asset allocation decisions. This implies that the staff of a central bank must be au fait with internationally acceptable risk management principles and practices, and must remain fully informed of developments in the world economy which may influence their assessment of relative risk/reward trade-offs.

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5.6.4 Administrator of exchange controls

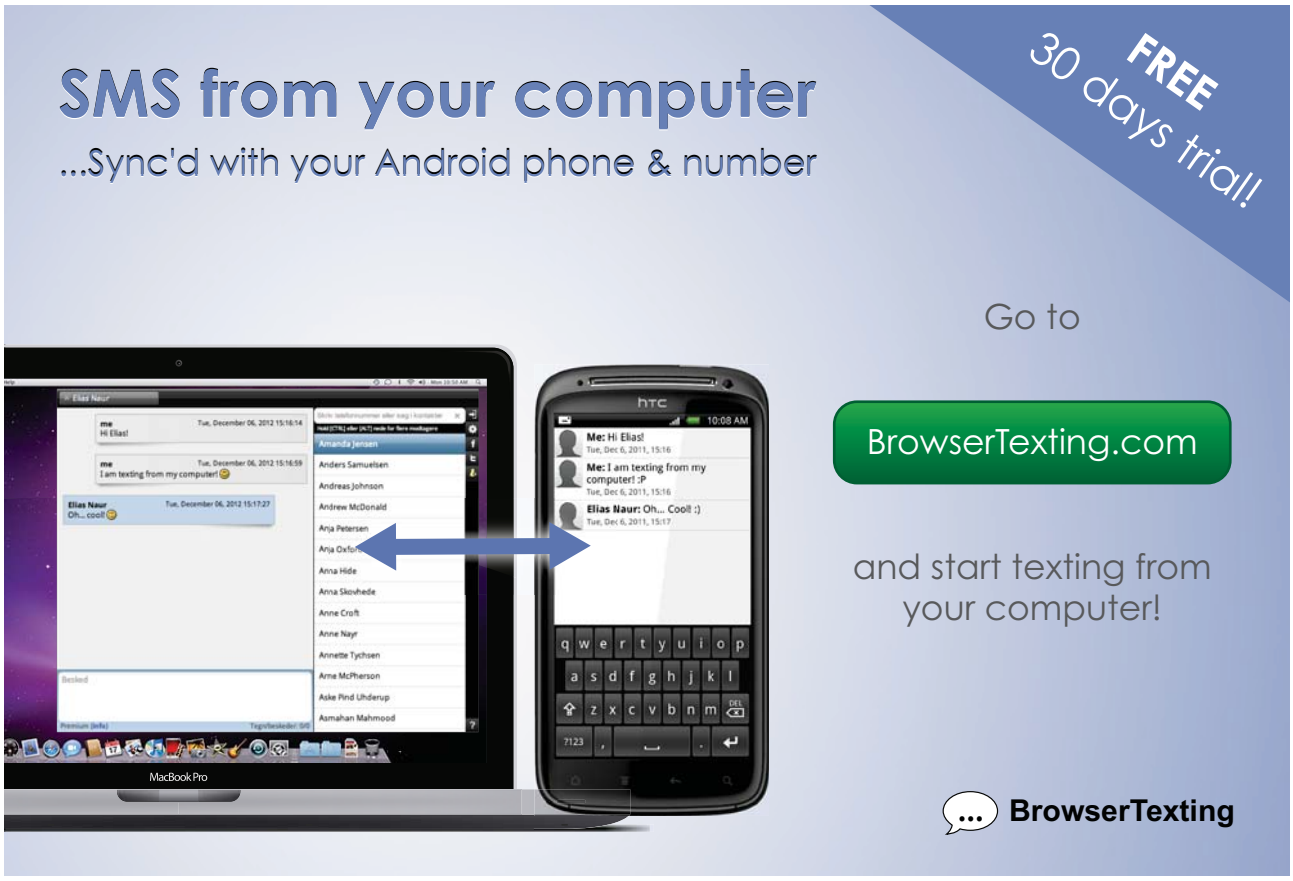
In certain countries where exchange controls still exist, the CB is usually appointed by Treasury as its agent for the administration of these controls.

5.7 Government

Governments are involved in the foreign exchange markets in that they are importers of goods at times, for example arms and aircraft. They are also importers of services. The government is also an international borrower at times. The LC government, for example, is an issuer of foreign bonds from time to time.

Foreign bonds are long-term bonds issued by governments in foreign currency in the country of the currency. For example, LC at time issues bonds denominated in USD in the United States, termed *Yankee* bonds. Similarly, LC has also issued bonds in Japan denominated in JPY, termed *Samurai* bonds. If a country issues bonds in the United Kingdom in GBP they are called *Bulldog* bonds.

These foreign bonds are also called *traditional international bonds*, and they are usually arranged by the investment banks of the country in which they are issued or investment banks that have an international presence with which the issuing government has a relationship.



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Much of the foreign exchange transactions of government are arranged by the CB as the government's agent. Government is also responsible for exchange control, and delegates this function to the CB to carry out on its behalf.

5.8 Retail clients

Retail clients are involved in the foreign exchange markets in a number of ways. They, for example:

- make investments abroad
- undertake vocational tours outside the country
- pay for their children's' education at foreign institutions
- send money gifts, etc.

In their dealings in foreign exchange, the retail clients have a choice of institution to transact with: the authorised banks (mainly with Bureaux de Change that are owned by the banks) and other small outfits that are authorised by the central to operate a limited business in foreign exchange.

5.9 Non-bank authorised dealers

As noted, retail clients have a choice with whom to deal when buying and/or selling foreign exchange. The non-bank authorised dealers in foreign exchange are authorised to do so by the central bank on behalf of the Treasury. Their business is circumscribed: the selling and/or buying of foreign bank notes, and the issuing of travellers cheques. The best examples of this type of company are Bureaux de Change (as noted, many of which are owned by the authorised dealer banks) and American Express.

The corporate sector also deals with the smaller non-bank authorised dealers in the case of international travel by their executives and employees.

5.10 Corporate sector

The corporate sector, next to the banks, makes up the heart of the foreign exchange market. Ignoring their retail requirements (for travel, etc.), this sector is the wholesale client base of the authorised dealer banks. This sector is made up of the importers, exporters, companies that have investments offshore and repatriate foreign exchange, investors such as pension funds, insurers and securities unit trusts, etc.

Some companies are such large participants in the foreign exchange markets (via the banks of course) that they have their own dealing rooms. This is usually part of a corporate treasury department. Many companies also "outsource" this specialised function to other companies that specialise in treasury management.

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The corporate sector is involved in the foreign exchange market to the extent that they are importers, exporters, buyers of offshore services, sellers of services offshore, borrowers offshore, lenders offshore, investors offshore, etc. Certain of the larger companies that have their own dealing rooms, and therefore the expertise (or so they think!), are also speculators in the market.

Most of the companies are involved in both the spot and the forward markets. The importers usually pay for imports in a number of months' time and buy the relative currency forward (usually the USD). The exporters, on the other hand, expect to receive funds in a number of months' time and they sell the foreign currency forward. Investors offshore for a period usually buy the foreign currency spot, make the investment, and sell the foreign currency forward to coincide with the maturity of the investment.

Corporate participants usually routinely buy and sell exchange in the forward market, and this is because the majority subscribe to the risk management maxim that if the company is not a "professional" in a market it should not take risks in that market – it should only take risk in the market that is its habitat. However, there are times when corporate participants in the foreign exchange market take a "strong" view on the local currency. This is usually when the indicators of a direction in the local currency are obvious, or political disturbances take place, or when "everyone is talking the market up or down" which becomes self-fulfilling prophecy (particularly in a small market like the LC market).

When corporate participants in the foreign exchange markets take a negative view of the LCC, the "leads and lags" come into play, as discussed earlier. The dealing banks are aware of this taking place and they also act in this direction. Other speculators do the same.

5.11 Arbitrageurs

The definition of arbitrage is the exploitation of price differentials in different markets for profit without risk. "Without risk" is of course not possible, but likely in the case of prime securities and secure formal markets.

In most of the markets a section is usually devoted to the role of arbitrageurs. It must be stated upfront that arbitrage in the foreign exchange markets is limited, and this is so mainly because of three factors:

- The main reason for this is the fact that all currencies are quoted in terms of the USD, and, as noted above, non-USD currency to non-USD other currency rates are calculated via the USD (cross rates).
- AUD / USD, EUR / USD, USD / CAD (etc.) exchange rates are not only quoted in the relevant countries where they originate, but also in the main financial centres of the world. Thus, rates for currencies tend to be the same in every centre they are traded.
- Communications systems are extremely sophisticated, and information flashes around the world almost instantaneously.

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Between the two world wars many foreign currencies were quoted against the home currencies. Thus a German bank could get a quote on the Dutch gilder against the Swiss franc in Switzerland. The fact that a bank could deal in many centres in other currencies meant that arbitrage opportunities arose. Communications were also not as efficient at that time.

Although arbitrage opportunities are limited, it is appropriate to explain the principle. There are three types of arbitrage (here we ignore spreads and transaction costs):

- Financial centre arbitrage (where there are price discrepancies between financial centres).
- Cross-currency arbitrage (where the cross rate of a currency differs from an actual quote).
- Arbitrage in the forward market (finding discrepancies between interest rate differentials and the forward discount and forward premium).

We provide an example of financial centre arbitrage (as noted, where there are price discrepancies between financial centres). For example, if the EUR/USD exchange rate:

- in London = EUR / USD 0.9745 (= USD / EUR 1.0262)
- in New York = EUR / USD 0.9730 (= USD / EUR 1.0277)

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an opportunity exists for dealers to *buy the GBP in New York* and *sell the GBP in London* for the same settlement date and make a riskless profit. On a EUR 1 000 000 deal, the dealer will buy the EUR for USD 973 000 in New York (i.e. pay this amount), and sell the EUR in London for USD 974 500 (i.e. receive this amount). Ignoring the spread and other transactions costs, s/he will make a profit of USD 1 500 (USD 974 500 – USD 973 000).

It should be apparent that many dealers around the world would spot this anomaly in price. The consequence is that there would be a scramble to buy the EUR in New York and sell it in London, driving the price of EUR up in New York and down in London. The EUR / USD exchange rate will settle somewhere between the two rates, say EUR / USD 0.9738 (= USD / EUR 1.0269).

Thus, the EUR in New York appreciates (USD depreciates) while it depreciates in London (USD appreciates).

5.12 Speculators

Speculators are not actually a separate category. They are comprised of some of the members of the groups covered above that take positions in the foreign exchange markets. The speculators are mainly the banks, which may be regarded as the "professionals" in this market, and the corporate sector, which take speculative positions from time to time, but usually only when "certain" opportunities exist. Individuals are also known to speculate on a small scale.

Speculation in the foreign exchange market is the accepting or taking on of currency risk, i.e. the risk of exchange rate movements. Clearly they do so because they believe that currency values will be such in future that they will be able to make a profit.

Examples of speculation were discussed earlier. A company importing or exporting, where payment is to be made or received at some stage in the future, *is speculating if forward cover is not purchased*. A LC importer, who has to pay USD 1 million in three months from now, does not know the amount of USD to be paid at that time if it waits and does a spot transaction at that time. Similarly, an exporter knows the amount of foreign exchange that it will receive on the future payment date, but it does not know what the value of the foreign exchange is in local currency. The amount in local currency is only certain if a forward deal is done.

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A speculator may also take an "open position" in the forward market without outlaying any funds upfront. For example, a company (note that only large companies that are well known in the market are able to do these deals) may decide that the forward rate for 90 days quoted now, say USD/LCC 10.55, is higher that the expected spot rate at expiry of the forward contract. S/he will sell USD 1 million forward for 90 days at this rate. If upon expiry of the contract the spot rate is USD/LCC 10.45, s/he will buy USD 1 million for LCC 10 450 000 (USD 1 000 000 × 10.45) (i.e. pay out of LCC 10 450 000) and fulfil the contract at USD/LCC 10.55 (i.e. supply USD1 000 000 and receive LCC 10 550 000). The difference between the payout and the receipt of LCC is a handsome profit of LCC 100 000. S/he will smile blissfully.

It will be clear that if the spot rate (assume USD/LCC 10.65) at expiry of the forward contract is higher than the forward contract rate USD/LCC 10.55), the speculator will make a loss of LCC 100 000. Upon expiry of the contract s/he will buy USD spot at a cost of LCC 10 650 000 (i.e. lay out this amount) and fulfil the contract at USD/LCC 10.55 (receive LCC 10 550 000.

Conversely, a speculator may decide that a 90-day forward contract is incorrectly priced at USD/LCC 10.55, and that the spot rate in 90 days' time will be LCC 10.65. S/he will buy a USD 1 000 000 forward contract. If on expiry the spot rate is USD/LCC 10.65, the writer of the forward contract (a bank) will supply USD 1 000 000 at a cost to the speculator of LCC 10 550 000. The speculator will sell the USD 1 000 000 at the spot rate of USD/LCC 10.65 and receive LCC 10 650 000. A profit of LCC 100 000 will have been made, and the speculator will treat his girlfriend / her boyfriend (or his boyfriend or her girlfriend) to a slap-up dinner complemented by the best derivative of the vine on the menu.

Speculators play a significant role in the currency markets in that they are instrumental in increasing turnover in the markets. A higher level of liquidity means that it is easier to buy and sell currencies without bringing about "large" price changes. In non-liquid markets, prices may be affected by relatively small deals.

5.13 Summary

There are a number of participants in the forex markets of the world and each has a unique role. They are:

- Authorised dealer banks.
- Foreign exchange brokers.
- Foreign banks.
- Central bank.
- Government.
- Retail clients.
- Non-bank authorised dealers.
- Corporate sector.
- Arbitrageurs.
- Speculators.

The latter two categories are not really separate groups but are made up of members of the other groups.

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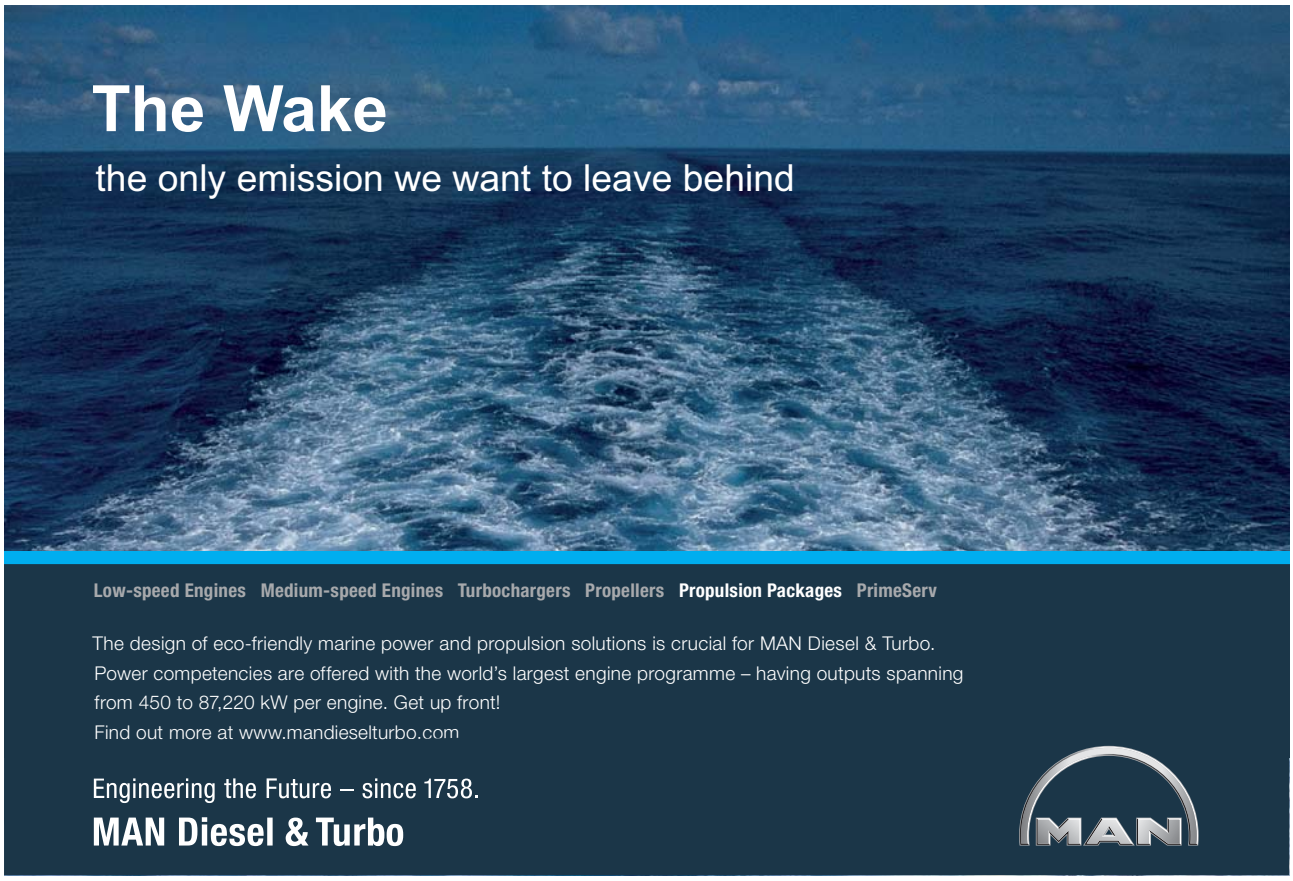

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6 Effect on money stock & money market liquidity

6.1 Learning objectives

After studying this text the learner should / should be able to:

- Analyse and describe the effects of forex transactions on the money stock (MS).
- Analyse and describe the effects of forex transactions on the money market / liquidity shortage (MMS / LS).
- Describe the effect on the MS and the LS of the following transactions: purchase and sales of forex, forward market operations of the central bank, forex swaps by the central bank.

6.2 Introduction

Central banks (CBs) intervene in the forex markets from time to time. This they do by adding to or depleting their international reserves, i.e. their portfolio of forex reserves. "Adding" means buying forex, and "depleting" means selling forex. The forex is bought from or sold to the local dealing banks. These transactions in most cases have an immediate effect on the money stock and money market liquidity (also sometimes called bank liquidity), and of course the exchange rate.

The dealing banks also operate extensively in the forex market, and their operations also have an effect on the money stock and the money market, although in the latter case to a lesser degree. This text is an attempt to elucidate the influence of the CB's and the private sector banks' operations in the forex market on the money stock and the money market liquidity situation. It is arranged as follows:

- The money identity.
- The money market identity.
- Purchase and sales of forex.
- Forward market operations of the central bank.
- Forex swaps by the central bank.

6.3 Money identity

The money identity is derived from the statements of assets and liabilities ("balance sheets") of the institutions that make up the so-called monetary banking sector (MBS). These are the institutions that are the custodians of the money of the country and are involved in the money creation process. They are the:

- central bank (CB), and the
- private sector banks (PSBs).

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Some countries have other monetary institutions that belong with this illustrious group, such as land banks, rural banks, mutual banks, building societies and so on, but here we assume that the abovementioned are the only members of the MBS.

Assets		Liabilities	
E. Foreign assets	1 200	A. Notes and coins	1 000
		B. Deposits	
F. Govt securities (= loans to)	1 000	1. Government	800
		2. Banks (total reserves – TR)	500
G. Loans to banks @ KIR	300	a. Required reserves (RR) (500)	
		b. Excess reserves (ER) (0)	
		C. Foreign loans	100
		D. Central bank securities (CBS)	100
Total	**2 500**	**Total**	**2 500**

Table 1: Central bank (CB) (LCC millions)

Assets		Liabilities	
C. Bank notes and coins	100		
D. Reserves with CB (TR)	500		
1. Required reserves (RR) (500)		A. Deposits	10 000
2. Excess reserves (ER) (0)			
E. Loans to NBPS	9 000	B. Loans from CB @ KIR	300
F. Govt securities (= loans to)	600		
G. Central bank securities (CBS)	100		
Total	**10 300**	**Total**	**10 300**

Table 2: Private sector banks (PSBs) (LCC millions)

What is money? It is anything that is used as a means of payment / medium of exchange and as a unit of account, and in all countries it is made up of (we use the widest measure of money called M3):

- notes and coins (N&C) in circulation [i.e. in the hands of the non-bank private sector (NBPS) = companies and individuals], and
- bank deposits of the NBPS.

Both these are used as a means of payment; in fact in most countries N&C is a minor amount compared with bank deposits (2% and 98% respectively in some countries). It is so that in most countries economic units overwhelmingly pay other economic units with transfers of banks deposits.

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How is the money stock[26] measured? We present two tables to assist in this elucidation:

- Table 1 = the simplified balance sheet of the CB.
- Table 2 = the simplified balance sheet of the PSBs.

The numbers are arbitrary. The amount of N&C held by the NBPS is calculated by the deduction of the N&C held by the PSBs and from the total N&C liability of the CB as follows:

N&C held by NBPS = CB item A – PSBs item C
= LCC 1 000 million – LCC 100 million
= LCC 900 million.

Bank deposits held by the NBPS = PSBs item = LCC 10 000 million.

Therefore M3 = LCC 900 million + LCC 10 000 million = LCC 10 900 million.

We can also determine the counterparts of M3 and from this create an identity from which the balance sheet (BS) causes of changes (BSCoC) in M3 can be identified.

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The first step is to consolidate the balance sheets of the members of the MBS. This simply means that the items that are common to the balance sheets of the CB and the PSBs are netted out. These are indicated in colour in Table 3 and Table 4 and are:

- Notes and coins.
- Banks' required reserves (= 5% of bank deposits).
- CB loans to the PSBs.
- CB securities (which we assume are held entirely by the banks (which is almost always the case in reality).

The result of the netting out process is reflected in the consolidated balance sheet of the MBS as shown in Table 5.

Assets		Liabilities	
E. Foreign assets	1 200	A. Notes and coins	1 000
		B. Deposits	
F. Govt securities (= loans to)	1 000	1. Government	800
		2. Banks (total reserves – TR)	500
G. Loans to banks @ KIR	300	a. Required reserve (RR) (500)	
		b. Excess reserves (ER) (0)	
		C. Foreign loans	100
		D. Central bank securities	100
Total	2 500	Total	2 500

Table 3: Central bank (CB) (LCC millions)

Assets		Liabilities	
C. Bank notes and coins	100		
D. Reserves with CB (TR)	500	A. Deposits (PNBS)	10 000
1. Required reserves (RR) (500)			
2. Excess reserves (ER) (0)		B. Loans from CB @ KIR	300
E. Loans to NBPS	9 000		
F. Govt securities (= loans to)	600		
G. Central bank securities	100		
Total	10 300	Total	10 300

Table 4: Private sector banks (PSBs) (LCC millions)

Assets		Liabilities	
D. Foreign assets	1 200	A. Notes and coins	900
E. Government securities (= loans to)	1 600	B. Deposits	
F. Loans to NBPS	9 000	1. NBPS	10 000
		2. Government	800
		C. Foreign loans	100
Total	11 800	Total	11 800

Table 5: Consolidated balance sheet of MBS (LCC millions)

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From Table 5 it will be evident that:

M3 = items A + B1 = LCC 900 million + LCC 10 000 million
= LCC 10 900 million.

It will also be evident that (because balance sheets balance):

M3 = A + B1 = (D + E + F) – (B2 + C)
= 10 900 = (1 200 + 1 600 + 9 000) – (800 + 100)
= 11 800 – 900
= LCC 10 900 million.

If we now group the related items (foreign sector and government sector) we get the identity:

M3 = (D – C) + (E – B2) + F
= (1 200 – 100) + (1 600 – 800) + 9 000
= 1 100 + 800 + 9 000
= LCC 10 900 million.

In words:

M3 (money stock)	= D – C	[net foreign assets – NFA]
	+ (E – B2)	[net loans to government – NLG]
	+ F	[loans to private sector – LPS].

This is the money identity. As noted, from this we are able to identify the counterparts of M3, and they are NFA, NLG and LPS. If we (and all CBs do) analyse this data from one period to another (say from month to month) we are able to identify the BSCoC as follows:

$$\Delta M3 = \Delta NFA + \Delta NLG + \Delta LPS.$$

We can go one step further and combine NLG and LPS into domestic loan extension (DLE) because they represent loans:

$$\Delta M3 = \Delta NFA + \Delta DLE.$$

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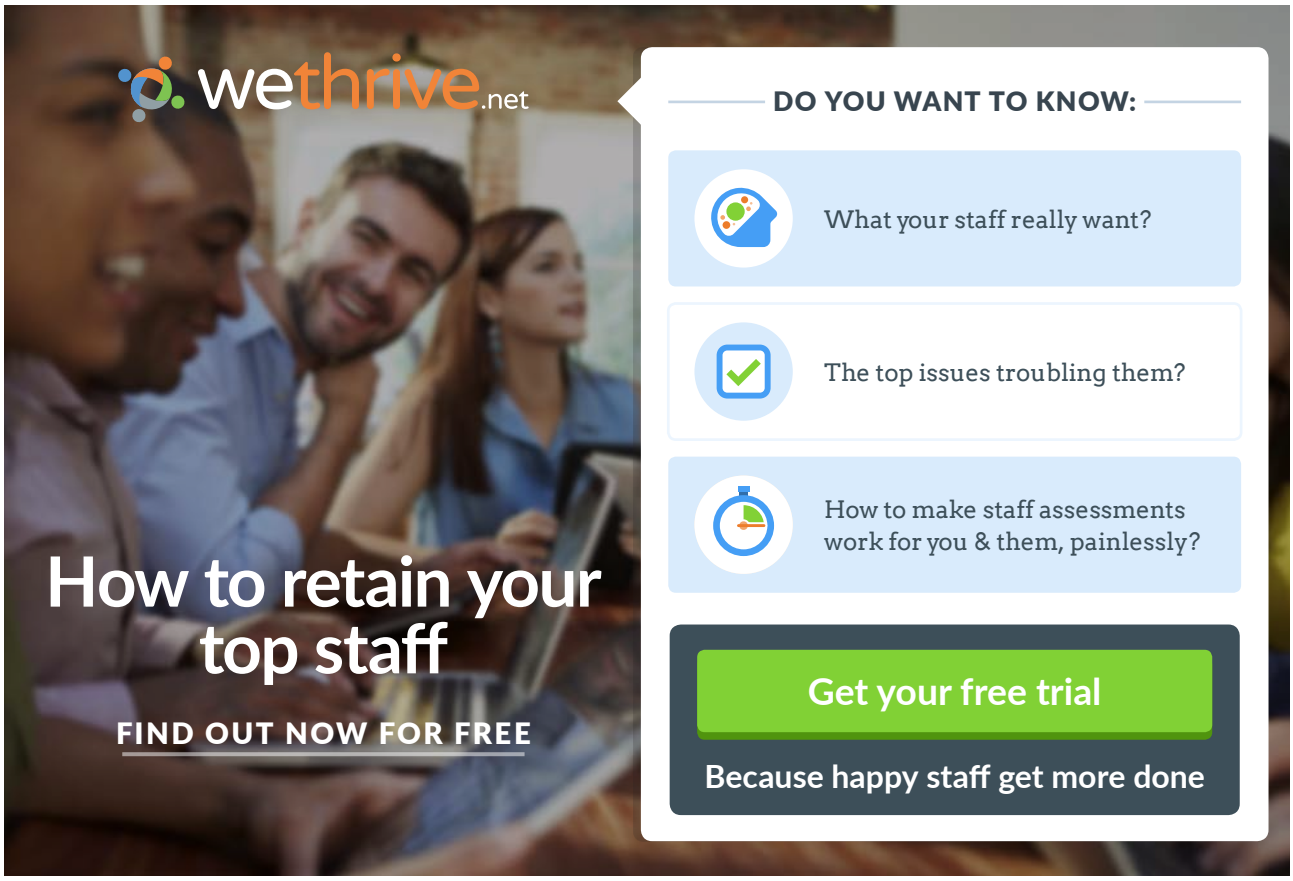
This means that the change in M3 over a period is caused by the BS changes in NFA (which amount to foreign loans) plus the BS change in DLE (domestic loans). However, the *actual or real* causes of changes in M3 are the factors that underlie these BS causes of changes, and they are:

- Private sector bank and central bank forex deals (purchases, sales, borrowing, and repayment of forex).
- Government borrowing [= issues of marketable securities (leading to increases in government deposits) and spending (leading to decreases in government deposits)].
- Demand for bank loans by the NBPS, which is a function of many factors, of which the rate of interest charged by banks (prime rate or rates benchmarked on prime rate) is the most significant. Bank loans to the NBPS have two forms: non-marketable debt (e.g. overdrafts, mortgage finance) and marketable debt (e.g. corporate bonds, commercial paper).

Of these BSCoCs in M3 the overwhelming one in most countries is CLS. Essentially, monetary policy is aimed at the demand for loans, by "setting" the lending rates of the PSBs. And this occurs via the key interest rate (KIR) of the CB (known as the repo rate, discount rate, bank rate, base rate and so on). A critical element in monetary policy is "making the KIR effective", and this is achieved by ensuring that the PSBs are always indebted to the CB, i.e. that there is a money market shortage (MMS) also known as a liquidity shortage (LS).



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The KIR is levied on the borrowings of the PSBs from the CB. This is an interbank rate (the CB to PSB interbank market – cb2b IBM) that has an immediate and substantive effect on the bank-to-bank IBM – b2b IBM. The b2b IBM in turn has a major effect on bank deposit rates and, via the bank margin (which banks try and maintain at a "healthy" level), on bank lending rates [i.e. prime rate (PR) and related rates].

Bank lending rates, as seen, affect the demand for bank loans, and bank loan extension is the major factor in changes in M3. And M3 is a major factor in price developments, i.e. in inflation (if the economy cannot adjust to the increased demand for goods and services that underlies the demand for bank loans).

In a nutshell, monetary policy has the following "string" or "route" (parts of which are usually called the transmission mechanism):

> LS → KIR → cb2b IBM → b2b IBM → deposit rates → bank margin → PR → demand for bank loans → bank loan extension → M3 → inflation → GDE → BoP → GDP.

We are concerned here with the effect of the forex market on the changes in M3 and the money market. We have illuminated the money identity and now know that changes in M3 are "explained" or "caused" by changes in the counterparts NFA, NLG and LPS. We also know that the actual or real causes are the *dynamics* that underlie the BS causes.

We shall return to the money identity and specifically to the influence of changes in NFA on M3. First we need to give attention to the effect of NFA on the net excess reserves (NER) of the banking sector, which is a measure of bank liquidity. For this we need to understand the *money market identity*.

6.4 Money market identity

6.4.1 What is the liquidity shortage?

Before considering the money market identity, from which we lead on to a discussion on NFA and its effects on M3 and the liquidity shortage (LS), we need to understand the role of the LS in broader monetary policy. We have already touched upon it, and will take it further here.

The LS is the extent of accommodation or assistance granted by the CB to the banking system, i.e. it is the extent to which the banks have borrowed reserves (BR) from it in order to comply with the reserve requirement. There are many different ways in which CBs have provided borrowed reserves to the banks in the past. The method of accommodating the banks at present in many countries in the world is the repo method. Under this method the banks sell certain assets (mainly government securities) to the CB under agreement to repurchase them when they are able to. Essentially it is a short term loan, and we will portray it as such[27].

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It is fundamental to this discussion that no private bank can destroy or create cash reserves itself, i.e. influence the LS up or down. It can be influenced only by the public (and they don't know they are doing it) and by the CB itself.

6.4.2 Significance of the liquidity shortage

The liquidity shortage (LS) is an asset item in the balance sheet of the CB and changes in it come about as a result of changes in the other balance sheet items (which reflect the underlying causes). The LS is a vital ingredient in the implementation of monetary policy in Local Country. For this reason, the LS is always positive, i.e. the banks are always in a borrowed reserves situation.

The significance of the LS lies therein that it enables the CB to *make the KIR effective*. The KIR is essentially a short-term rate (i.e. a rate of interest for short term and one-day money). It is *always* above market call rates, making the CB's accommodation facility a true *last resort* facility. For this reason banks always strive to stay out of the clutches of the CB, i.e. not to borrow from the CB. Competition for funds between banks (in order to stay "*out the CB*") thus ensures that the interbank rate (b2b IBM), and therefore bank call rates, i.e. the lowest point on the yield curve, are always quoted with reference to (and not too removed from) the KIR.

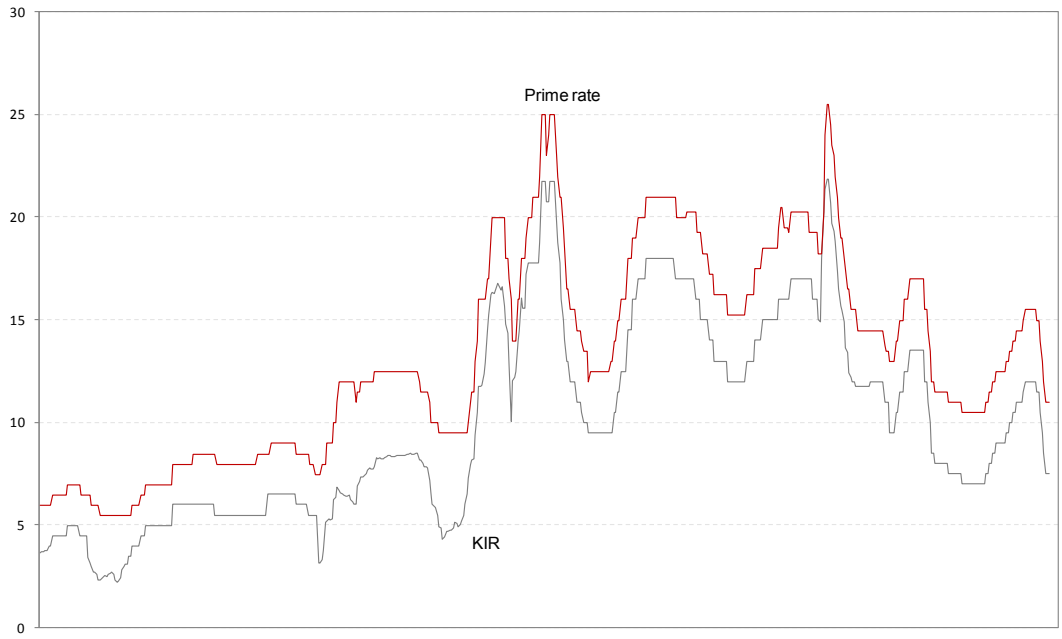

Figure 1: KIR & prime lending rate

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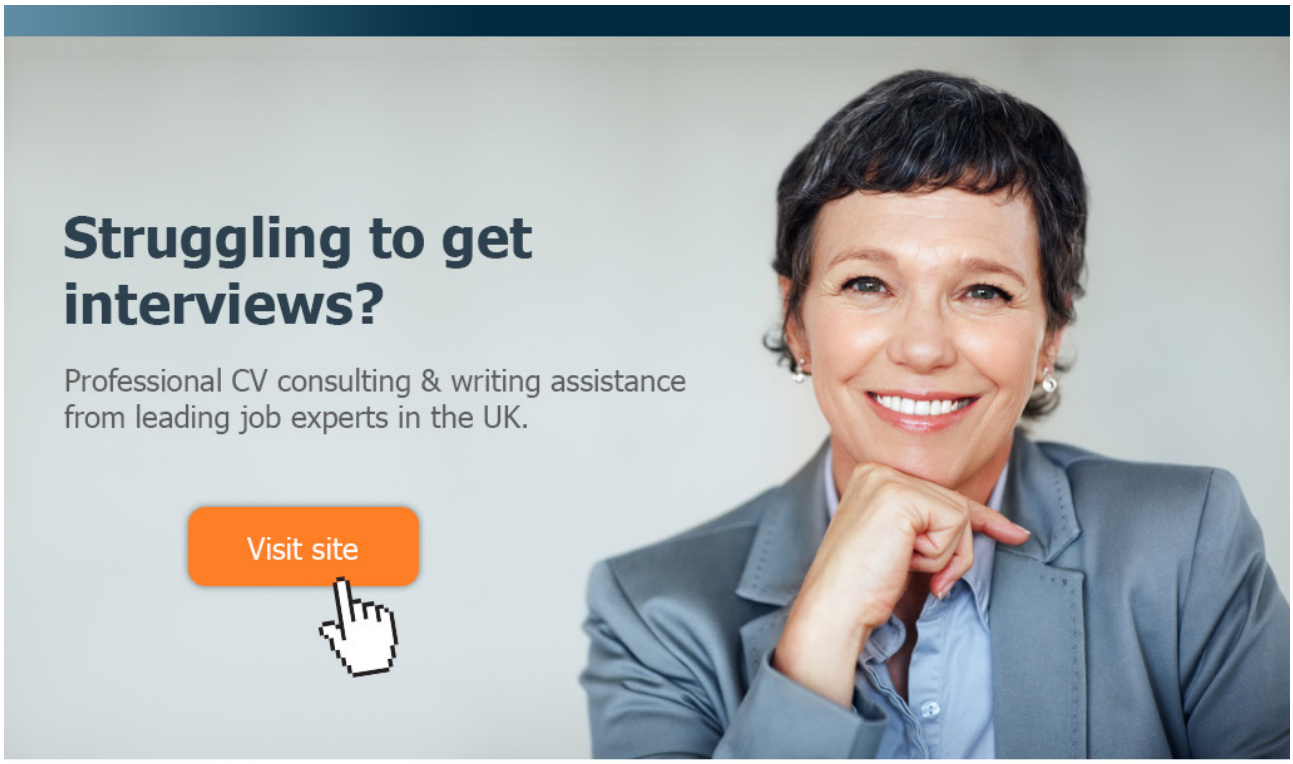
The essence of monetary policy lies therein that the KIR has a major influence on the banks' deposit rates. The KIR represents the cost of money for the banks *at the margin*. Because banks endeavour to maintain a particular margin between the cost of deposits and their lending rates, the CB indirectly influences the banks' lending rates, the most prominent of which is their prime lending rate (see Figure 1). This figure for LC[28] is significant because the KIR and the prime rate of the banks over 50 years have exhibited a correlation coefficient of 0.99.

Thus, by making KIR effective, the CB effectively "sets" the level of bank lending rates that, in turn, have a major influence on the growth rate in the demand for loans. As we have seen CLS is the main counterpart of M3. Thus, the CB, via the KIR, has a major influence on the growth rate in M3 and ultimately the rate of inflation.

The rate of inflation is one of the main ingredients in shaping the environment in which business operates. Too high a rate of inflation becomes a negative factor (mainly because of its effect on the exchange rate) in business decisions, and therefore ultimately on economic growth.



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6.4.3 A concept of bank liquidity: net excess reserves

The LS is only part of what can be called the ultimate bank liquidity story, albeit the significant part in terms of effective monetary policy. There are many countries where the banks (for many reasons) have money market surpluses from time to time. The concept that captures this situation and a LS at the same time is net excess reserves (NER), and this is made up of:

- excess reserves (ER), i.e. reserves with the CB in excess of required reserves (RR, in our example above = 5% of bank deposits)
- less: the extent of PSB borrowings from the CB = BR = the LS.

It will be evident that TR = RR + ER and that a portion of RR can be borrowed (BR). An illumination of this concept, changes therein, and the causes of changes is discussed next.

6.4.4 An analysis of the causes of changes in the net excess reserves

When banks have reserves with the CB in excess of required reserves, these are held on their settlement accounts (SAs). Banks have two accounts with the CB:

- Reserve accounts: for required reserves (RR), a function of the total of banks deposits (in our example = 5% of deposits).
- Settlement accounts; interbank settlements occur over these accounts, as will become clearer later.

This is the case in most countries. In some countries the two accounts are merged into one and called a "reserve account". This account will have a "required" component and a "surplus" component (or no surplus). We assume here that the banks have one reserve account with the CB.

It is to be noted that most CBs do not pay interest on these accounts. This is a significant issue because banks have no incentive to hold excess reserves with the CB. In some countries the banks perennially have excess reserves and have no option but to have these reserves on their CB accounts.

Table 6 provides a simple example of the CB's balance sheet, from which we can extract the net excess reserves (NER) of the banks and the BS causes of changes. The banks have zero ER and have borrowings from the CB (BR) of LCC 300 million. Thus:

NER = item B2b – item G
= LCC 0 – LCC 300
= LCC -300 million.

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Assets		Liabilities	
		A. Notes and coins	1 000
E. Foreign assets	1 200	B. Deposits	
		1. Government	800
F. Govt securities	1 100	2. Banks (total reserves – TR)	500
		a. Required reserves (RR) (500)	
G. Loans to banks (BR @ KIR)	300	b. Excess reserves (ER) (0)	
		C. Foreign loans	200
		D. Central bank securities	100
Total	2 600	Total	2 600

Table 6: Central bank (CB) (LCC millions)

It should be evident that:

$$NER = B2b - G = (E + F) - (A + B1 + B2a + C + D).$$

As in the case of the money identity we group together the related items such that:

NER = B2b – G	= (E – C)	[net foreign assets – NFA]
	+ (F – B1)	[net loans to government – NLG]
	- A	[notes and coins in circulation – N&C]
	- B2a	[required reserves – RR]
	- D	[central bank securities – CBS]

This is the *money market identity*. Using the numbers from Table 6, we have:

NER = B2b – G	= 0 – 300	= LCC -300
= E – C	= 1 200 – 200	= 1 000
+ F – B1	= 1 100 – 800	= 300
- A	= -1 000	
- B2a	= -500	
- D	= -100	

The total of the counterparts of NER is LCC -300 = NER.

From this it will be evident that:

$$\Delta NER = \Delta NFA + \Delta NLG - \Delta A - \Delta B2a - \Delta D.$$

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This says that any change in the NER of banks is caused in a BS sense changes in NFA, NLG (and inversely by) A, B2a and D.

It will be evident that the NER of banks only changes from one period to another *if something else in the CB's balance sheet changes*, and that this can only be brought about by the CB itself, or the public (and this only applies to item A). *The banks are not able to influence the shortage*.

The fact that the banks themselves are not able to create or destroy reserves, ie to influence their liquidity condition (collectively), is a critical issue because it means that the CB itself has absolute (almost) control over bank liquidity, and therefore on monetary policy. Given this, there is no excuse for the poor conduct of monetary policy by central bankers.

It should be clear that:

- A rise in liability item will increase the LS and reduce NER.
- A rise in an asset item will reduce the LS and increase NER.
- A decrease in a liability item will reduce the LS and increase NER.
- A decline in an asset item will increase the LS and reduce NER.

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It is important to note that these so-called *causes of changes* in the NER of the banking sector are merely the BS causes. The actual or *real causes* are the underlying transactions of the CB itself (called *managed factors*) or the public (called *unmanaged factors = item A*) that bring about changes in the BS items.

6.5 Purchases and sales of forex, M3 and the liquidity shortage

6.5.1 Introduction

In both the money identity and the money market identity the item that interests us in this text, i.e. NFA, appeared. It will also have been noticed that the CB is part of the monetary banking sector (MBS). From this it may be deduced that when the CB intervenes in the forex market, its operations will influence (in most cases) both M3, the LS and NER. However, if the private banking sector buys or sells forex, these operations will influence M3 but not necessarily the LS. A number of examples will be covered here:

- CB borrowing of forex.
- CB sells forex to the dealing banks.
- Dealing banks sell USD 50 million to importers.
- Importers pay for goods imported.
- Exporters earn USD 50 million from exports to the US, sell the forex to the dealing banks, and the CB buys the forex in the market.
- The dynamics underlying changes in NFA.

6.5.2 Central bank borrowing of forex

When the CB borrows forex (USD 50 million; exchange rate: USD/LCC 10.0) the following changes take place in its balance sheet.

CENTRAL BANK (LCC MILLIONS)			
Assets		Liabilities	
Forex	+ 500	Foreign loans	+ 500

US BANKING SYSTEM (USD MILLIONS)			
Assets		Liabilities	
Loans to LC CB	+ 50	Deposits of LC CB	+ 50

There is no change in M3, the LS or NER, and the US banking system's balance sheet is expanded.

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MONETARY ANALYSIS (LCC MILLIONS)	
M3	-
Causes of change: Gross foreign assets Less: foreign liabilities* NFA	 + 500 - 500 -
Total causes	-
* Increase -; decrease +	

MONEY MARKET ANALYSIS (LCC MILLIONS)	
Excess reserves (ER) Less: BR / LS*	- -
NER	-
Causes of change: Gross foreign assets* Less: foreign liabilities NFA	 + 500 - 500 -
Total causes	-
* Increase -; decrease +	

6.5.3 Central bank sells forex to the dealing banks

If the LC CB sells forex USD 50 million into the local market, the banks will purchase the exchange before selling it on to another participant.

CENTRAL BANK (LCC MILLIONS)			
Assets		Liabilities	
Forex Loans to banks	- 500 + 500		

PRIVATE SECTOR BANKS (LCC MILLIONS)			
Assets		Liabilities	
Forex	+ 500	Loans from the CB	+ 500

US BANKING SYSTEM (USD MILLIONS)			
Assets		Liabilities	
		Deposits of LC CB Deposits of LC PSBs	- 50 + 50

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There is no change in M3, but:

- the LS has increased by LCC 500 million
- NER has fallen by LCC 500 million.

MONEY MARKET ANALYSIS (LCC MILLIONS)	
Excess reserves (ER) Less: BR / LS*	- - 500
NER	- 500
Causes of change: Gross foreign assets Less: foreign liabilities* NFA	 - 500 - - 500
Total causes	-500
* Increase -; decrease +	

6.5.4 Dealing banks sell USD 50 million to importers

When the dealing banks sell forex to the importers, the following balance sheet changes come about (assumption here: cash reserve requirement = 2% of deposits).

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CENTRAL BANK (LCC MILLIONS)			
Assets		Liabilities	
Loans to banks	- 10	Required reserves	- 10

PRIVATE SECTOR BANKS (LCC MILLIONS)			
Assets		Liabilities	
Forex Required cash reserves	- 500 - 10	Deposits of importers Loans from CB	-500 -10

LC IMPORTERS (LCC MILLIONS)			
Assets		Liabilities	
Forex Deposits at LC banks	+ 500 - 500		

US BANKING SYSTEM (USD MILLIONS)			
Assets		Liabilities	
		Deposits of LC banks Deposits of LC importers	- 50 + 50

MONETARY ANALYSIS (LCC MILLIONS)	
M3	- 500
Causes of change: Gross foreign assets Less: foreign liabilities* NFA	 - 500 - - 500
Total causes	- 500
* Increase -; decrease +	

MONEY MARKET ANALYSIS (LCC MILLIONS)	
Excess reserves (ER) Less: BR / LS*	- + 10
NER	+ 10
Causes of change: Gross foreign assets Less: foreign liabilities* NFA Required reserves (RR)*	 - - - + 10
Total causes	+ 10
* Increase -; decrease +	

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6.5.5 Importers pay for goods imported

The Local Country importers use the acquired forex to pay for goods purchased from US exporters.

LC IMPORTERS (LCC MILLIONS)			
Assets		Liabilities	
Forex Goods	- 500 + 500		

US EXPORTERS (USD MILLIONS)			
Assets		Liabilities	
Goods Deposits at US banks	- 50 + 50		

US BANKING SYSTEM (USD MILLIONS)			
Assets		**Liabilities**	
		Deposits of LC importers Deposits of US exporters	- 50 + 50

There is no change in M3, the LS or NER.

5.5.6 Exporters earn USD 50 million from exports to the US, sell the forex to the dealing banks, and the central bank buys the forex

In the hypothetical example of exporters exporting USD 50 million worth of Local Country goods, selling the forex to the dealing banks, and the CB buying the forex in the market, the following balance sheet changes occur.

LC EXPORTERS (LCC MILLIONS)			
Assets		Liabilities	
Goods Deposits at LC banks	- 500 + 500		

US IMPORTERS (USD MILLIONS)			
Assets		Liabilities	
Goods Deposits at US banks	+ 50 - 50		

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US BANKING SYSTEM (USD MILLIONS)			
Assets		Liabilities	
		Deposits of LC CB Deposits of US importers	+ 50 - 50

LC PRIVATE SECTOR BANKS (LCC MILLIONS)			
Assets		Liabilities	
Required reserves	+ 10	Deposits of exporters Loans from CB	+ 500 -490

LC CENTRAL BANK (LCC MILLIONS)			
Assets		Liabilities	
Forex Loans to banks	+ 500 - 490	Required reserves	+ 10

M3 increases by LCC 500 million and the statistical cause of change is an increase of the same magnitude in NFA. The actual cause of change is the CB's purchase of the forex earned by the exporters. It should be evident that this action by the CB causes the money stock to expand by LCC 500 million, and extracts LCC 500 million forex from the forex market, thus preventing an appreciation of the LCC.

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MONETARY ANALYSIS (LCC MILLIONS)	
M3	**+ 500**
Causes of change: Gross foreign assets Less: foreign liabilities* NFA	 + 500 - + 500
Total causes	**+ 500**
* Increase -; decrease +	

The LS falls by LCC 490 million (NER improves by this amount), with the statistical causes being an increase in NFA of LCC 500 million and an increase in required reserves of LCC 10 million (because the deposit liabilities of the banks increased by LCC 500 million). The actual cause was the purchase by the CB of LCC 500 million of forex reserves, causing M3 to increase by LCC 500 million, which has a cash reserve requirement effect.

MONEY MARKET ANALYSIS (LCC MILLIONS)	
Excess reserves (ER) Less: BR / LS*	- + 490
NER	+ 490
Causes of change: Gross foreign assets Less: foreign liabilities* NFA Required reserves (RR)*	 + 500 - + 500 - 10
Total causes	+ 490
* Increase -; decrease +	

6.5.7 The dynamics underlying changes in NFA

From the above examples the dynamics underlying changes in the net foreign assets of the monetary banking sector should be clear. The following may be mentioned in this regard in conclusion (before discussing forward market operations and the swap operations of the CB, and their influence on M3 and the LS and NER:

- *Transactions by the CB in the gold market*. For example, to the extent that the private sector banks or the CB build up their holdings of gold, M3 will increase. In the case of the CB, its purchases will cause the LS to fall (NER to improve).

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- *Exports*. If a company exports goods and is paid in forex (i.e. a deposit at a foreign bank), it is obliged to sell this to an authorised forex dealer (i.e. an authorised bank) within 180 days. If a bank decides to purchase this exchange for its own portfolio, M3 will increase. If the CB decides to build up its forex reserves, M3 will increase, and the LS will fall (NER rise).
- *Imports*. If the CB supplies forex to support imports, and to prevent the LCC from weakening, its sales of forex will cause M3 to fall and the LS to rise (NER to fall).
- *Actions of the CB to smooth out fluctuations in the forex market*. If the CB decides to support the LCC with borrowed forex, and the forex ends up in the hands of the private sector, M3 will fall, and the LS will increase (NER fall). If the CB decides the LCC should weaken, and buys forex, its action will cause M3 to rise and the LS to fall (NER rise).

From the above, it should be apparent that if the private sector banks and the CB do not interfere (intervene) in the forex markets, there would be no effect on M3 and the LS/NER. The exchange rate will find its own level according to the supply of and the demand for forex.

In smaller markets, the exchange rate tends to be volatile at times (a function to a large degree of capital in- and outflows). There is always a temptation to intervene in the forex markets in order to influence the exchange rate. A "price" is paid in the form of an influence on M3 and / or the LS/NER. For example, if capital flows into a country (supply of forex), and the CB decides this is not healthy because the appreciating exchange rate will negatively influence the competitive advantage enjoyed by exporters, it will most likely add to its portfolio of forex. The "price" paid is a rise in M3 (higher demand for goods and services) and improved bank liquidity (NER) (and lower LS), which may induce interest rates lower.

6.6 Forward market operations of the central bank

The forward market operations of the CB have an influence on M3 and the LS when they are undertaken to influence the exchange rate. If the CB offers forward exchange deals at a cheap exchange rate (i.e. an exchange rate that does not reflect the interest rate differential of the two relevant countries), it is able to encourage arbitrage opportunities, which eventually could lead to CB losses that influence M3 and the LS.

An example is required to explain this phenomenon. We assume the following:

US one-year interest rate (fir)	= 5.5% pa
LC one-year interest rate (dir)	= 10.5% pa
Spot rate (SR)	= USD/LCC 10.2

According to the principle of interest rate parity, the forward rate (FR) should be:

$$\begin{aligned}\text{Forward outright} &= \text{spot} \times [(1 + ir_{vc} \times d/365) / (1 + ir_{bc} \times d/365)] \\ &= 10.2 \times [(1 + 0.105 \times 365/365) / (1 + 0.055 \times 365/365)] \\ &= 10.2 \times 1.0439 \\ &= 10.6834\end{aligned}$$

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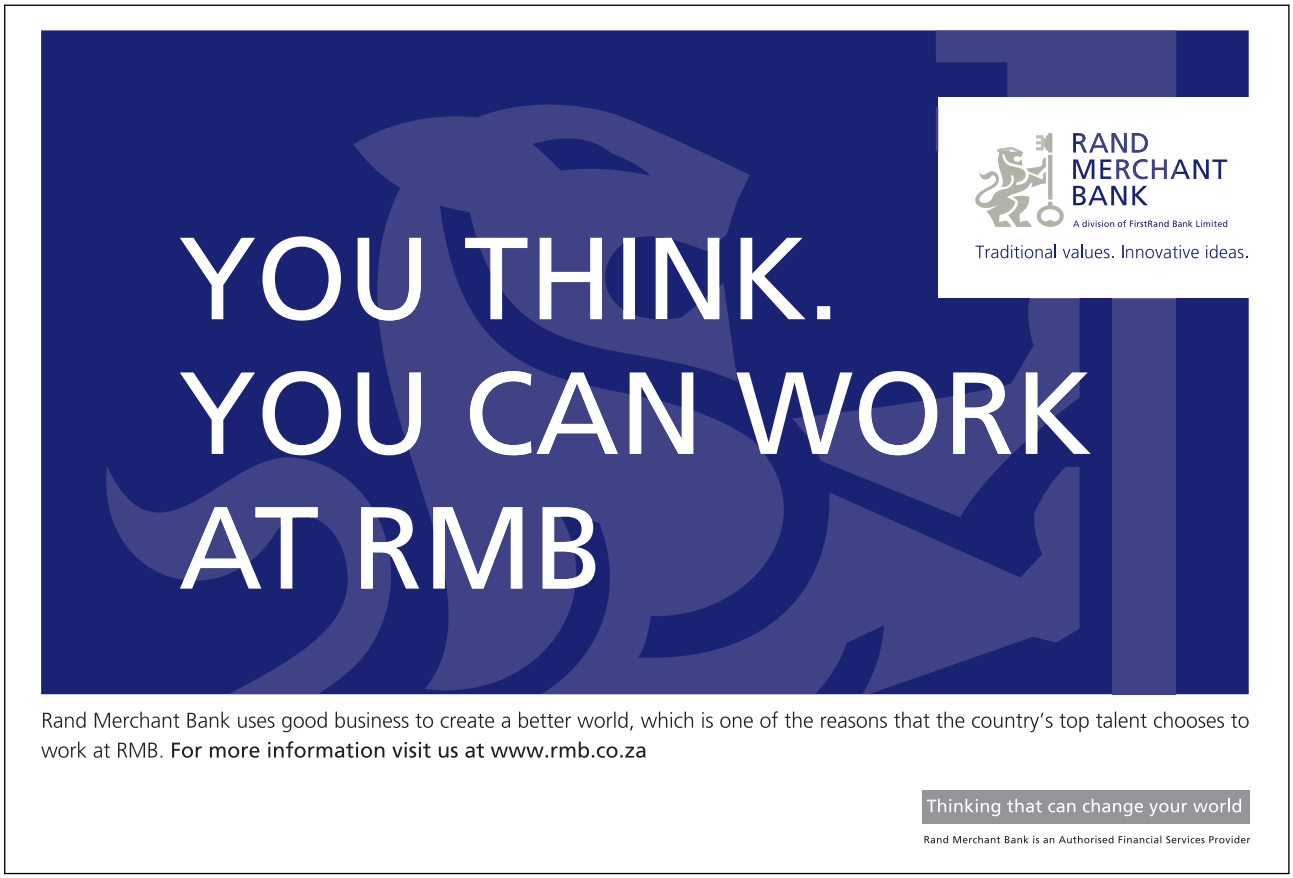
At any forward exchange rate of between USD/LCC 10.2 and USD/LCC 10.68, foreign investors and/or local borrowers that borrow overseas can make riskless profits from an investment in the Local Country money market.

If, for example, the CB provides forward cover for a year at USD/LCC 10.4, a local (sharp) company is able to borrow USD at 5.5% pa at an exchange rate of USD/LCC 10.2, buy (for example) a LCC 10 million one-year NCD at 10.5%, exit the investment after a year at maturity of the NCD, repay the foreign loan with the USD supplied by the CB at USD/LCC 10.4 (the forward rate) and enjoy the handsome risk-free profit. The following are the numbers:

US one-year interest rate	= 5.5% pa
LC one-year interest rate	= 10.5% pa
Spot rate	= USD/LCC 10.2
1 year forward rate	= USD/LCC 10.4
Spot rate in 1 year's time	= USD/LCC 10.8
Offshore borrowing (@ spot rate)	= USD 980 392.16 (1/10.2 × LCC 10 000 000)
Interest payable on foreign loan	= USD 53 921.57 (USD 980 392.16 × 0.055)
Sale to LC CB	= USD 980 392.16
Cost for CB	= LCC 10 000 000.00
Purchase of 1-year NCD	= LCC 10 000 000.00



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Interest on NCD = LCC 1 050 000 (LCC 10 000 000 × 0.105)
Maturity value (MV) of NCD = LCC 11 050 000 (LCC 10 000 000 + LCC 1 050 000)
Central bank purchases USD a year later = USD 980 392.16
Cost for CB (@ spot rate) = LCC 10 588 235.33 (USD 980 392.16 × 10.8)
Supply of USD to company = USD 980 392.16
Cost to company (at forward rate) = LCC 10 196 078.46 (USD 980 392.16 × 10.4)
Repayment of loan by company = USD 980 392.16
Payment of interest by company = USD 53 921.57
LCC cost of USD 53 921.57 (spot) = LCC 582 352.96 (USD 53 921.57 × 10.8)
Total profit for company =
LCC 271 568.58 [LCC 11 050 000 – (LCC 10 196 078.46 – LCC 582 352.96)].

It will be clear that the CB makes a loss (which ultimately is on behalf of government, i.e. the public). It buys the USD brought in by the local company and supplies the USD to the local forex market in an effort to forestall a fall in the LCC (in reality the CB will do many such deals). It buys the USD at the spot exchange rate of USD/LCC 10.2.

At the end of one year the CB is obliged to supply to the company (via the banking sector) USD 980 392.16 at the forward exchange rate of USD/LCC 10.4. The cost to the CB is LCC 10 196 078.46 (USD 980 392.16 × 10.8), i.e. the forex is bought at the spot rate prevailing then. The loss for the CB is LCC 196 078.46 (LCC 10 196 078.46 – LCC 10 000 000).

This amount is reflected in the M3 and the NER/LS numbers as follows (ignoring the balance of the company's profit which is reflected elsewhere in the system):

(SHARP) LC COMPANY (LCC)			
Assets		**Liabilities**	
Deposits at LC bank	+ 196 078.46	Profit	+ 196 078.46
Total change	**+ 196 078.46**	**Total change**	**+ 196 078.46**

CENTRAL BANK (LCC)			
Assets		**Liabilities**	
Loans to banks @ KIR Other assets (loss)	- 192 156.89 + 196 078.46	Required reserves	+ 3 921.57
Total change	**+ 3 921.57**	**Total change**	**+ 3 921.57**

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LC PRIVATE SECTOR BANKS (LCC)			
Assets		Liabilities	
Required reserves	+ 3 921.57	Deposits of (sharp) company Loans from CB @ KIR	+ 196 078.46 - 192 156.89
Total change	**+ 3 921.57**	**Total change**	**+ 3 921.57**

MONETARY ANALYSIS (LCC)	
M3	+ 196 078.46
Causes of change: Net other assets	 + 196 078.46
Total causes	**+ 196 078.46**
* Increase -; decrease +	

MONEY MARKET ANALYSIS (LCC MILLIONS)	
Excess reserves (ER) Less: BR / LS*	- + 192 156.89
NER	**+ 192 156.89**
Causes of change: Gross foreign assets Less: foreign liabilities* NFA Required reserves (RR)* Net other assets	 - - - **- 3 921.57** **+ 196 078.46**
Total causes	**+ 192 156.89**
* Increase -; decrease +	

The above money market analysis would have been a little confusing because net other assets (NOA) was not introduced earlier as a cause of change. In real life it is for the CBs that do this analysis. NOA includes all the other items such as capital and reserves, profits and losses and so on. In this example the CB made a loss (= an increase in other liabilities). Because NOA = other assets minus other liabilities (increase -; decrease +), NOA increases. Bank deposits also increase (of the sharp company); therefore required reserves increase.

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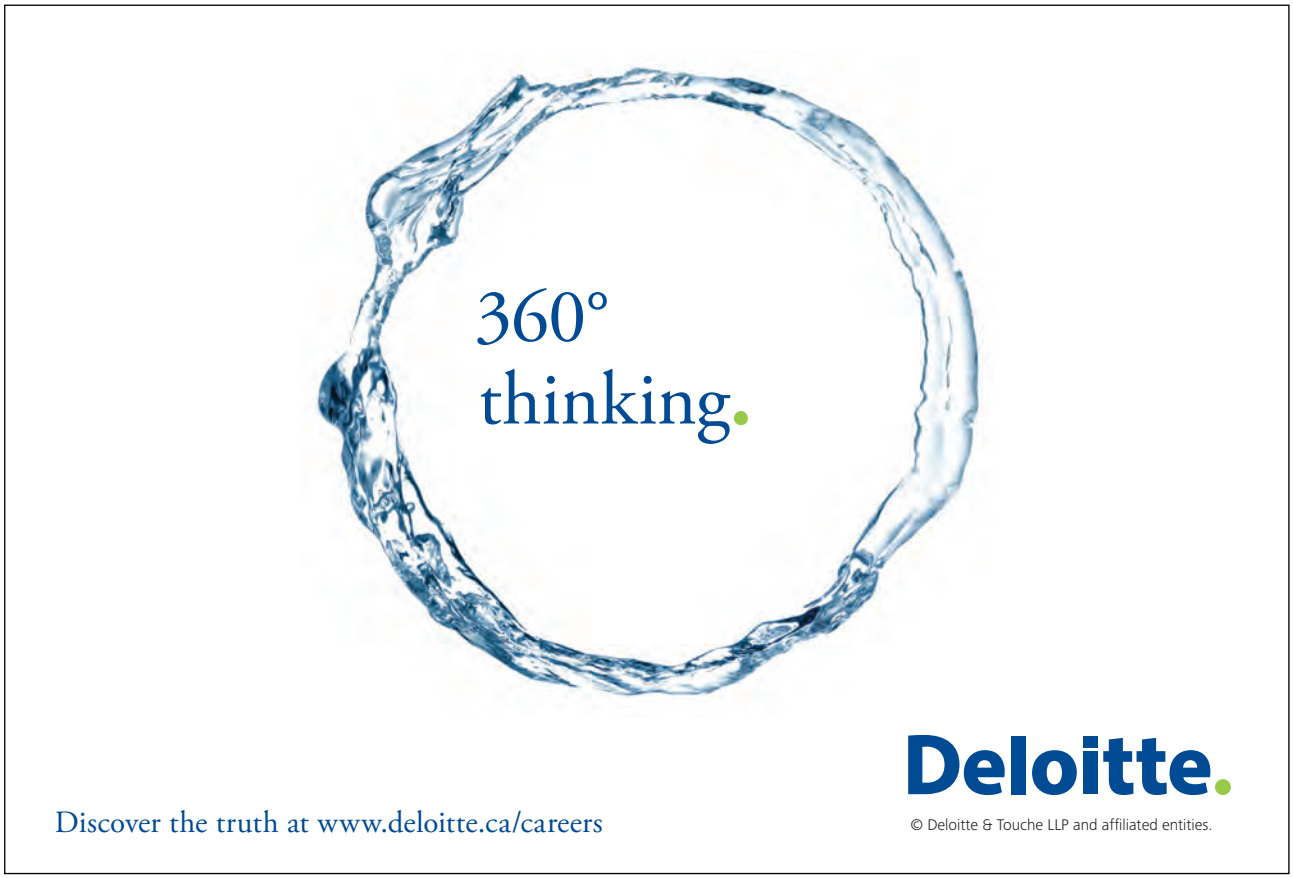
6.7 Forex swaps by the central bank

Forex swaps by the CB are often undertaken with the purpose of negating the liquidity-creating effect (i.e. reducing the LS) of its purchases of forex. The swaps are much like repurchase agreements (i.e. repos), i.e. the sale of an asset (in this case forex) to the banks with a simultaneous repurchase of the same asset on an agreed date in the future. As shown above, when a CB purchases forex from the banks, the LS falls by a commensurate amount (assume USD 100 million; exchange rate USD/LCC10.0.

CENTRAL BANK (LCC MILLIONS)			
Assets		Liabilities	
Forex Loans to banks	+ 1 000 - 1 000		

LC PRIVATE SECTOR BANKS (LCC MILLIONS)			
Assets		Liabilities	
Forex	- 1 000	Loans from CB	-1 000



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MONEY MARKET ANALYSIS (LCC MILLIONS)	
Excess reserves (ER) Less: BR / LS*	- + 1 000
NER	**+ 1 000**
Causes of change: Gross foreign assets Less: foreign liabilities* NFA Required reserves (RR)* Net other assets	 **+ 1 000** - **+ 1 000** - -
Total causes	**+ 1 000**
* Increase -; decrease +	

When the CB does a swap with the banks for the same amount, the opposite occurs in the balance sheets of the relevant intermediaries.

6.8 Summary

The forex operations (purchases, sales, lending, borrowing, repayments by lenders / borrowers) of any members of the household sector, the corporate sector, the government sector and financial institutions, impact in some form or other on the LS/NER and/or the money stock. Likewise, participation by the foreign sector in the local forex market impacts on these variables.

However, as a general rule, an impact on money market liquidity is only felt if the CB's balance sheet is affected by the transaction/s. An impact on the money stock is a consequence of other changes in the banking sector's consolidated balance sheet.

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7 Endnotes

1. This is a currency code of fictitious country Local Country (its monetary unit is "corona").
2. McInish, 2000: 264.
3. McInish, 2000: 263.
4. McInish, 2000: 264.
5. Some countries in turbulent times accept other countries' currencies as their monetary unit (for example, Argentina had the USD as their monetary unit, until early 2002).
6. Section 17 ("Legal tender") provides: "(1) A tender, including a tender by the Bank itself, of a note of the Bank or of an outstanding note of another bank for which the Bank has assumed liability…shall be a legal tender of payment of an amount equal to the amount specified on the note. (2) A tender, including a tender by the Bank itself, of an undefaced and unmutilated coin which is lawfully in circulation in the Republic and of current mass, shall be a legal tender of payment of money…and the value of each coin so tendered shall be equal to the amount specified on that coin."
7. International Standards Organisation.
8. Society for Worldwide Interbank Financial Telecommunications.
9. Note that some literature uses a different convention for forex quotes. For example LCC/USD 7.34 will mean number of LCC per USD. We follow the convention of quotations as they appear on the screens of participants in the forex markets.
10. McInish (2000:265) explains in this regard: "For a set of n currencies there are potentially n^2 combinations. Eliminating the n combinations of each currency with itself and dividing the difference by 2 to eliminate reciprocal quotations gives a potential of $(n^2 - n) / 2$ quotations between different currencies. Using only the USD quotations reduces this number to $n - 1$." According to the former formula, given an assumed 190 currencies, the combinations are 17 955. According to the latter formula the number is 189. Clearly therefore, the convention adopted is to facilitate trading.
11. Note that in this text we have assumed a 365 day-count convention. In some countries it is different from 365 days. For example, in the US it is 360 days.
12. Adapted from McInish (2000: 271–272).
13. "Forex Review", *Business Report*, 29 August 2003.
14. Andre Faure of Andisa Capital on 3 September 2003
15. Keep in mind that TMCs deal on behalf of clients (like some MHCs) that prefer to not have their own treasury divisions, and therefore "outsource" this to the specialists. It is like fund management with a difference.
16. Example adapted from Steiner (1998: 7–8).
17. See Steiner (1998: 177).
18. The ship is really slow.
19. This is an example from a particular country; changes have been made.
20. This example is an adaptation of an example in Hull, CH (2000: 135–137), and it can be called a *fixed for fixed swap*.
21. This draws to a degree on Rose, 2000.
22. This draws to a degree on Rose, 2000.

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23. Example from McInish (2000: 279)
24. Note that the following sections are largely from www.reservebank.co.za, and in many cases verbatim. We have used their texts because we realise we cannot do better than a central bank. We have substituted LCC for ZAR, and central bank or Local Country central bank (LC CB) for South African Reserve Bank. Because of this, and because we have also made small changes, we have not placed some of the texts' in inverted commas.
25. Verbatim, with minor changes from www.reservebank.co.za.
26. Note that we do not call the money stock the money "supply" because we believe that bank loans are supplied and money creation is the consequence of this (and another factor) as we shall see.
27. It is actually the sale of securities to the CB under repo, but for reporting purposes the banks have to "put" the repo assets back on balance sheet and show a counterbalancing item of the liability of the balance sheet: a loan from the CB. This is the item that we call the MMS or the LS.
28. It is actually for a particular country which, as can be seen, has a good record in terms of the effectiveness on the KIR (called many different names: repo rate, discount rate, bank rate, base rate, and so on).

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