# 2 Derivative markets: forwards

## 2.1 Learning outcomes

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

1. Describe the characteristics of forward markets.
2. Explain the essence and mechanics of forward contracts / instruments.
3. Understand the mathematics of the forward markets.
4. Calculate a forward price.
5. Distinguish the advantages and disadvantages of forward markets vis-à-vis futures markets.
6. Portray the organisational structure of the forward markets.

## 2.2 Introduction

Forward markets / instruments are the forerunners of the futures markets / instruments. However, not all forwards transmuted into futures markets. The *forward foreign exchange market*, for example, is a gargantuan market in terms of turnover and liquidity. There are also a number of other formidable forward markets such as forward markets in interest rate products (e.g. forward rate contracts). This significant derivative market is covered under the following headings:

- Spot market.
- Introduction to forward markets.
- A simple example.
- Forward markets.
- Forwards in the debt markets.
- Forwards in the foreign exchange market.
- Forwards in the commodities markets.
- Forwards on derivatives.
- Organisation of forward markets.

## 2.3 Spot market: defintion

As we saw earlier, the spot market is also called the "cash market", and it refers to transactions or deals (which are contracts) that are settled at the earliest opportunity possible. For example (see Figure 1), in the money market a spot deal is where securities are exchanged for payment (also called *delivery versus payment*) on the day the deal is struck / transacted (T+0) or the following day. In many bond markets a spot deal is a deal done now (day T+0) for settlement in 3 days' time (T+3). In most share / equity markets spot means T+5. In the money market, deals are usually settled on the day of the transaction (T+0) or the following day (T+1).

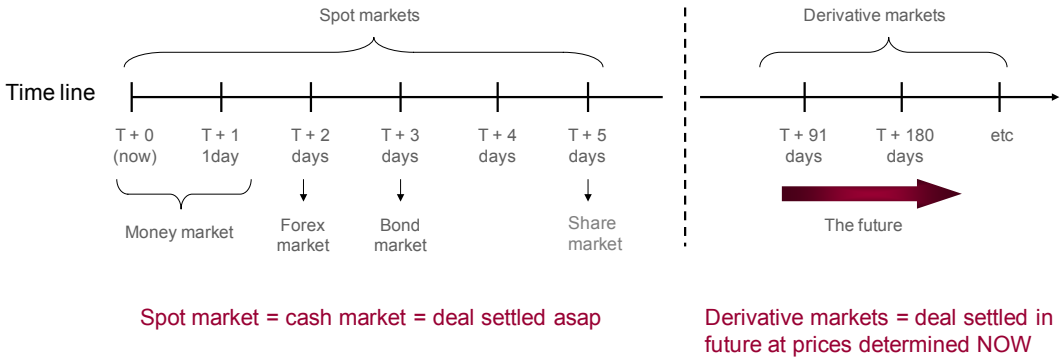


**Figure 1:** spot & forward settlement (derivative markets)

The issue that determines the number after the "+" sign is essentially convenience. In the money market it is convenient to settle now or tomorrow, because the market is of a wholesale nature and the securities are kept in safe custody by banks in large metropolitan areas (or in a securities depository or are dematerialised). In the share market many individuals are involved that are spread across the county and, therefore, it takes time for the securities to be posted / sent to the exchange. This of course changes with dematerialisation / immobilisation[7].

A spot deal may thus be defined as a contract between buyer and seller, undertaken on T+0, for the delivery of a security by the seller to the buyer and payment by the buyer to the seller in order to complete settlement of the deal at time T+0 or T+ a few days, depending on convenience / convention.

## 2.4 Forward market: defintion

Like a spot deal, a forward deal is a deal done now (T+0) at a price agreed now. However (and this is the difference), the settlement date is *not* a few days after T+0 as in the case of spot transactions, but usually a month or a few months after T+0 (see Figure 2.1). The motivation for such a deal is usually that the *spot price* that will prevail in the future is uncertain. A forward deal removes the spot price uncertainty.

The best way to describe a forward deal is with an example. Consider a wheat farmer. He plants his crop now and expects to reap the harvest in 3 months' time. He knows the input cost, but he does not know what spot price he will get for his harvested wheat in 3 months' time. Thus, he is faced with (spot) price risk (uncertainty). The solution to his risk is a forward (or futures) market that will enable him to sell his wheat forward, in other words he would like to deal now (T+0) at a price agreed now (T+0) for delivery of the wheat in 3 months' time (T+ 3 months) when he will be paid.

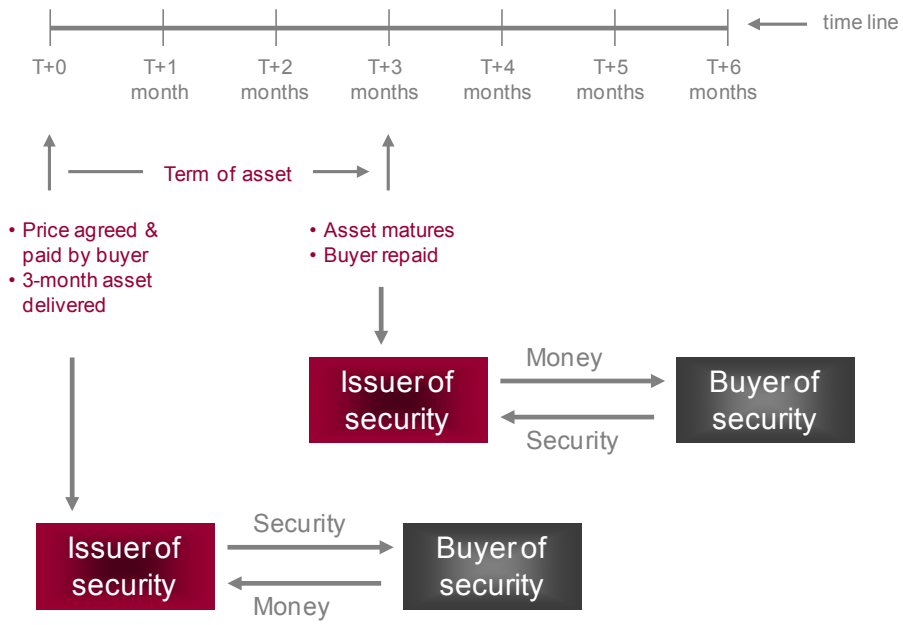


**Figure 2:** spot deal on T+0 on 3-month asset

A forward deal in the financial markets is the same except that the instrument dealt in:

- has a term to maturity and
- may have an income (dividend on a share / interest on a bond).

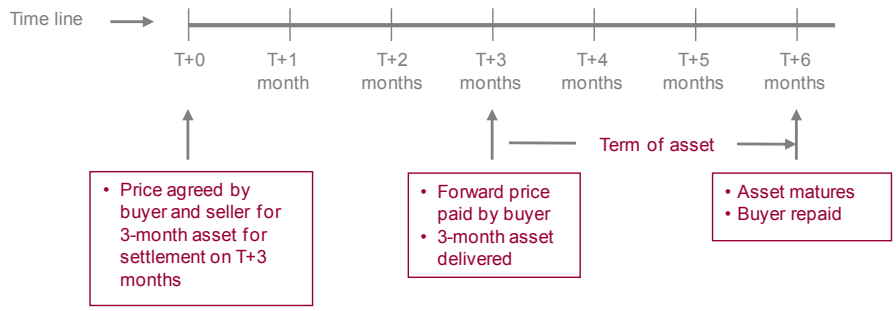


**Figure 3:** forward deal on 3-month asset (settlement in T+3 months)

A spot deal on a 3-month financial asset is portrayed as in Figure 3. A forward deal is where the price or rate on an asset is determined now for settlement at some stage in the future. *Some stage* means *other that spot*. A 3-month forward deal on a 3-month asset is shown in Figure 3.

Thus a forward is a contract between a buyer and a seller that obliges the seller to deliver, and the buyer to accept delivery of, an agreed quantity and quality of an asset at a specified price (now) on a stipulated date in the future. A simple example will clarify this definition further see Figure 4).

## 2.5 An example


**Figure 4:** example of forward deal

A forward transaction is effected on 18 September (T+0). On this day the spot price of a basket of maize (corn) is LCC100. A consumer (buyer) believes that the price of maize (his favourite food) will be much higher in three months' time (because of an anticipated drought). He would thus like to secure a price now for a basket of maize he would like to purchase in three months' time.

The farmer (producer and seller), on the other hand, believes that the price of maize will decline (because he anticipates plenty of rain). The farmer quotes the buyer a price of LCC103.74, i.e. he undertakes to supply the buyer with one basket of maize on 18 December (after 91 days) for a consideration (price) of LCC103.74. This figure the farmer arrived at by taking into account the interest rate he is paying the bank for a loan used to produce the mielies. Assuming the interest rate to be 15.0% pa, he calculates the forward price according to the following formula (= cost of carry model):

$$FP = SP \times [1 + (ir \times t)]$$

where

FP = forward price
SP = spot price
ir = interest rate per annum for the term (expressed as a unit of 1)[8]
t = term, expressed as number of days / 365

$$FP = LCC100 \times [1 + (0.15 \times 91 / 365)]$$
$$= LCC100 \times (1.037397)$$
$$= LCC103.74.$$

The buyer draws up a contract, which both Mr Farmer and he (Mr Consumer) sign (see Box 1).

Forward Contract

18 September 2010

Mr Consumer hereby undertakes to take delivery of, and Mr Farmer hereby undertakes to deliver, one basket of maize on 18 December 2010 at a price of LCC103.74.

Signed

…… ……..
Mr Farmer Mr Consumer

**Box 1:** Example of forward contract

On 18 December (after a drought) the price for a basket of maize (i.e. the spot price) has risen to LCC120. The consumer pays the farmer LCC103.74 and takes delivery of the basket of maize. What is the financial position of each party to the forward contract?

- *The buyer* pays LCC103.74. Had he waited until 18 December to purchase his basket of maize, he would have had to pay the spot price of LCC120. If, in the 91-day period, he had "gone off" maize, he will still be happy to purchase the basket at LCC103.74, and this is because he will sell the same basket at LCC120 (the spot price now on 18 December). He thus profits to the extent of LCC16.26 (LCC120 – LCC103.74) (and is annoyed with himself that he did not take a larger "position").
- *The farmer* is thin-lipped because he could have sold the basket of maize on 18 December for LCC120. This does not mean that he made a loss. His production cost, including his carry cost, could only have been, say, LCC95. He thus makes a profit of LCC8.74 (LCC103.74 – LCC95), but it is smaller than he would have made (LCC120 – LCC95.00 = LCC25) in the absence of the forward contract.

Had it rained and the supply of maize increased, the price would most likely have fallen. If we assume the spot price had fallen to LCC90 per basket on 18 December, the farmer is better off (received LCC103.74 as opposed to LCC90), whereas the buyer is worse off (paid LCC103.74 as opposed to LCC90 had he not done the forward deal).

It is important at this stage to attempt to analyse the *advantages and disadvantages* of forward markets. The main *advantages* that can be identified are:

- Flexibility with regard to delivery dates.
- Flexibility with regard to size of contract.

The disadvantages are:

- The transaction rests on the *integrity of the two parties*, i.e. there is a risk of non-performance.
- Both parties are "*locked in*" to the deal for the duration of the transaction, i.e. they cannot reverse their exposures.
- *Delivery* of the underlying asset took place, i.e. there was no option of settling in cash.
- The *quality of the asset* may vary.
- *Transaction costs are high* (for example, the consumer visits the farmer at least twice, has a lawyer to draw up the contract, etc.).

## 2.6 Forward markets

Futures markets developed out of forward markets because of the disadvantages of forward deals. However, forward markets do still exist, and this is because of their advantages as mentioned above and the *lack of the disadvantages mentioned above in some markets*. The following will make this clear:

- Flexibility with regard to delivery dates.
- Flexibility with regard to size of contract.
- The transaction rests on the integrity of the two parties, but this is not a problem in certain markets where the participants are substantive in terms of capital and expertise (e.g. the forex market).
- Both parties are "locked in" to the deal for the duration of the transaction, but in certain markets they are able to reverse their exposures with other instruments (e.g. futures in the forex market).
- Delivery of the underlying asset is the purpose of doing a forward deal in most cases (i.e. the client does not want the option of settling in cash) (e.g. forex market).
- The quality of the asset does not vary in many cases (e.g. forex market).
- Transaction costs are not high in certain markets (e.g. forex market because of high degree of liquidity).

As will have been guessed, the largest forward market is the forward foreign exchange market. In addition, forward markets exist in the debt market, the share market and in the commodities market. This means that there are forward markets in all the financial markets.

In addition to the forwards that exist in all the financial markets there are also forwards on one of the derivatives, i.e. swaps. The forward markets are discussed under the following sections:

- Forwards in the debt markets.
- Forwards in the share / equity market.
- Forwards in the foreign exchange market.
- Forwards in the commodity markets.
- Forwards on derivatives.

## 2.7 Forwards in the debt markets

### 2.7.1 Introduction

The forward market contracts that are found in the debt markets are:

- Forward interest rate contracts.
- Repurchase agreements.
- Forward rate agreements.

### 2.7.2 Forward interest rate contracts

#### 2.7.2.1 Introduction

A forward interest rate contract (FIRC) is the sale of a debt instrument on a pre-specified future date at a pre-specified rate of interest. This category includes forwards on indices of interest rate instruments (such as forwards on the GOVI index). Below we provide examples of FIRCs in the OTC market and the exchange-traded markets:

- Example: OTC market.
- Examples: exchange-traded markets.

### 2.7.2.2 Example: OTC market

An example is probably the best way to describe the forward market in interest rate products, i.e. forward interest rate contracts. As noted, these contracts involve the *sale of a debt instrument on a pre-specified future date at a pre-specified rate of interest*, and contain details on the following:

- The debt instrument/s.
- Amount of the instrument that will be delivered.
- Due date of the debt instruments.
- Forward date (i.e. due date of the contract).
- Rate of interest on the debt instrument to be delivered.

An insurance company requires a LCC100 million (plus) 206-day negotiable certificate of deposit (NCD) investment in 100 days' time when it receives a large interest payment. It wants to secure the rate now because it believes that rates on that section of the yield curve are about to start declining, and it cannot find a futures contract that matches its requirement in terms of the exact date of the investment (100 days from now) and its due date (306 days from now).

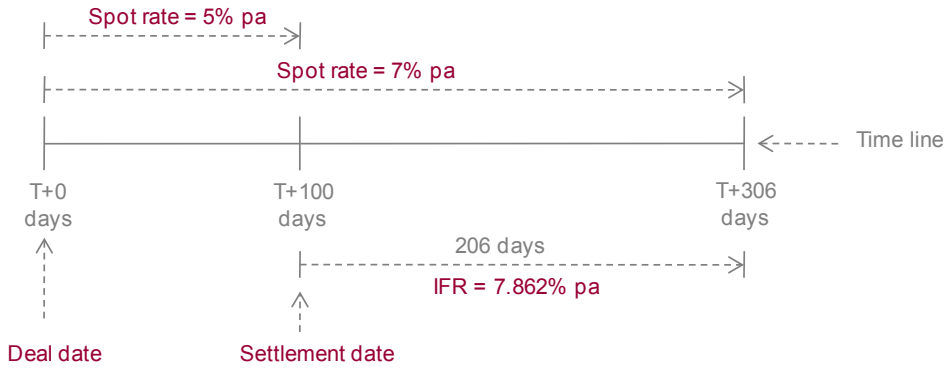


**Figure 5:** example of forward interest rate contract

It approaches a dealing bank and asks for a forward rate on LCC100 million (plus) 206-day NCDs for settlement 100 days from now. The spot rate (current market rate) on a 306-day NCD is 7.0% pa and the spot rate on a 100-day NCD is 5% pa. It will be evident that the dealing bank has to calculate the rate to be offered to the insurer from the existing rates. This involves the calculation of the rate *implied* in the existing spot rates, i.e. the *implied forward rate* (IFR) (see Figure 5):

$$IFR = \{[1 + (ir_L \times t_L)] / [1 + (ir_S \times t_S)] - 1\} \times [365 / (t_L - t_S)]$$

where

$ir_L$ = spot interest rate for the longer period (306 days)
$ir_S$ = spot interest rate for shorter period (100 days)
$t_L$ = longer period, expressed in days / 365) (306 / 365)
$t_S$ = shorter period, expressed in days / 365) (100 / 365)

$$\begin{aligned}
\text{IFR} &= \{[1 + (0.07 \times 306 / 365)] / [1 + (0.05 \times 100 / 365)] - 1\} \times 365 / 206 \\
&= [(1.05868 / 1.01370) - 1] \times 365 / 206 \\
&= (1.04437 - 1) \times 365 / 206 \\
&= 0.07862 \\
&= 7.862\% \text{ pa.}
\end{aligned}$$

The bank will quote a rate lower than this rate in order to make a profit. However, we assume here, for the sake of explication, that the bank takes no profit on the client. It undertakes to sell the NCDs to the insurer at 7.862% pa after 100 days.

The financial logic is as follows[9]: the dealing bank could buy a 306-day NCD from another bank and sell it under repo (have it "carried") for 100 days; the repo buyer will earn 5.0% pa for 100 days and the ultimate buyer, the insurer (the forward buyer) will earn the IFR of 7.862% pa for 206 days. The calculations follow:

1. The dealing bank buys LCC100 million 306 day NCDs at the spot rate of 7.0% pa. The interest = 7.0 / 100 × LCC100 000 000 × 306 / 365 = LCC5 868 493.15.
2. The maturity value (MV) of the investment = cash outlay + interest for the period = LCC100 000 000 + LCC5 868 493.15 = LCC105 868 493.15.
3. The bank has the NCDs "carried" for 100 days at the spot rate for the period of 5.0% pa. This means it sells the LCC100 million NCDs at market value (LCC100 million) for a period of 100 days at the market rate of interest for money for 100 days.
4. After 100 days, the bank pays the "carrier" of the NCDs interest for 100 days at 5.0% pa on LCC100 million = LCC100 000 000 × 5.0 / 100 × 100 / 365 = LCC1 369 863.01.
5. The bank now sells the NCDs to the insurer at the IFR of 7.862% pa. The calculation is: MV / [1 + (IFR / 100 × days remaining to maturity / 365)] = LCC105 868 493.15 / [1 + (7.862 / 100 × 206 / 365)] = LCC101 370 498.00.
6. The insurer earns MV – cash outlay for the NCDs = LCC105 868 493.15 – LCC101 370 498.00 = LCC4 497 995.10 for the period.
7. Converting this to a pa interest rate: [(interest amount to be earned / cash outlay) × (365 / period in days)] = [(LCC4 497 995.10 / LCC101 370 498.00) × (365 / 206)] = 7.862% pa, i.e. the agreed rate in the forward contract.

Essentially what the dealing bank has done here is to hedge itself on the forward rate quoted to the insurer. It will be evident, however, that the bank, while hedged, makes no profit on the deal. As noted, in real life the bank would quote a forward rate lower than the break-even rate of 7.862% pa (e.g. 7.7% pa.)

The principle involved here, i.e. "carry cost" (or "net carry cost" in the case of income earning securities), is applied in all forward and futures markets. This will become clearer as we advance through this text.

The above is a typical example of a forward deal in the debt market. It will be apparent that the deal is a private agreement between two parties and that the deal is not negotiable (marketable). The market is not formalised and the risk lies between the two parties. It is for this reason that the forward interest rate contract market is the *domain of the large players*, and these are the large banks, and the institutions[10].

Numbers in respect of OTC FIRCs are not available.

### 2.7.3 Repurchase agreements

#### 2.7.3.1 Introduction

A knowledgeable student will have noted that the above deal (the OTC FIRC) could have been executed by the insurer by way of the celebrated *repurchase agreement* (repo). The insurer could have bought the NCDs outright and sold them to some other holder of funds under repo for 100 days. Similarly the bank could have bought the NCDs outright, sold them under repo for 100 days and then sold them outright to the insurer.

In most international textbooks, the repo is not covered under derivative instruments, but is rather regarded as a money market instrument. We regard the repo as a derivative because it is *derived* from money or bond market instruments, and its value (i.e. the rate on it) is *derived* from another part of the money market (the price of money for the duration of the repo).

The repo may also be seen as a combination of a spot and a forward transaction, specifically a spot sale and a simultaneous forward purchase of the same instrument (from the point of view of the seller / maker). The buyer of the repo does a simultaneous spot purchase and forward sale.

The repo may also be regarded as a short-term loan secured by the assets sold to the lender. Another way of putting this is that the repo is similar to a collateralised loan in that the purchaser of the securities under repo is providing funds to the seller and its loan is backed by the securities for the period of the agreement; the lender receives a return based on the fixed price of the agreement when it is reversed.

The repo is discussed in much detail here because it is a versatile instrument and the market in this instrument is vast. The sections we cover here are:

- Definition
- Terminology
- Example
- Purpose of effecting repurchase agreements
- Participants in the repurchase agreement market
- Types of repurchase agreements
- Securities that underlie repurchase agreements
- Size of repurchase agreement market
- Mathematics of repurchase agreements
- Repos and the banking sector
- Listed repurchase agreements.

#### 2.7.3.2 Definition

A repurchase agreement (repo) is a contractual transaction in terms of which an existing security is sold at its market value (or lower) at an agreed rate of interest, coupled with an agreement to repurchase the same security on a specified, or unspecified, date. This definition perhaps requires further elaboration.

***Agreement***

The transaction note confirming the sale of the security can contain a note stipulating the agreement to repurchase. Alternatively, two transaction notes can be issued, i.e. a sale note together with a purchase note dated for the agreed repurchase date. It is market practice that underlying all repurchase agreements is the TBMA / ISMA Global Master Repurchase Agreement, (GMRA), i.e. an internationally recognised repo contract.

***Existing security***

The maker of the repo sells a security already in issue to the buyer of the agreement.

***Market value***

The security is sold at its market value (and sometimes at better, i.e. lower, than market value), in order to protect the buyer of the repo against default of the maker. If the seller fails to repurchase the security at termination of the repo, the holder acquires title to it and has the right to sell it in the market. For example, if the value of the securities sold is LCC9 500 000, the repo is done at a value of LCC9 450 000, and the interest factor for the period of the repo is LCC35 000 (total = LCC9 485 000), the buyer is protected should the maker default.

***Agreed rate of interest***

The agreed rate for the term of the agreement is the interest rate payable on the repo by the seller for the relevant period. This applies in the case where the maturity date of the agreement is specified. A small number of repos are "open repos", i.e. both the buyer and the seller have the right to terminate the agreement at any time. The rate payable on these open repos is a rate agreed between the two parties to the deal; the rate may be benchmarked or it may be agreed daily.

***Specified maturity date***

The specified maturity date is the date when the agreement is terminated. The buyer sells the security / securities underlying the repo back to the maker for the original consideration plus the amount of the interest agreed.

***Unspecified maturity date***

In the case of an agreement where the maturity date is not specified (the *open* repo), the termination price (original consideration plus interest) cannot be agreed at the outset of the agreement. The rate at which interest is calculated can be fixed or floating, but is usually the latter. In the case of a floating rate, as noted, the rate would be an agreed differential below or above a benchmark rate.

#### 2.7.3.3 Terminology

The terminology related to repo is often confusing to those not involved in the money market. The term *repurchase agreement* applies to the seller of the agreement. He agrees to *repurchase* the security. The buyer of the agreement, on the other hand, is doing a *resale agreement*. He agrees to *resell* the security to the maker of the agreement.

Synonyms for the repurchase agreement are *buy-back agreement* (point of view of the maker) and *sell-back agreement* (point of view of the buyer). Repurchase agreements are also frequently referred to *warehousing transactions*. The seller is doing a *warehousing transaction* and the buyer is *warehousing* an asset.

Terminology also used by some participants is *repo-in* and *repo-out*. The former is a *resale agreement* and the latter a *repurchase or buy-back agreement*. Both makers and buyers, however, sometimes use the word *carry*. The maker would say he is having securities *carried*, while the buyer would say he is *carrying* securities.

The terminology used by the many central banks in their accommodation procedures and open market operations is also a challenge. They generally accommodate the banks by doing *repos* at the *KIR*. What the central banks are actually doing are *resale agreements* with the banks. The banks are doing *repurchase agreements* with the central banks.

At times central banks sell securities to the banks to "mop up" liquidity, i.e. to increase the money market shortage. They refer to these as *reverse repos*. In fact, they are not reverse repos from the central bank's point of view; they are *repos*.

Similarly, when the central bank sells foreign exchange to the banks in order to "mop up" liquidity, it says it does *forex swaps* with the banks. This is true, but the transactions may be seen to be repurchase agreements with the banks in foreign exchange at the money market rate, less the relevant foreign interest rate for the term of the repo. This is discussed in detail later.

The majority of participants and certainly the central bank mainly use the term repo, and we will acquiesce in this regard, but use the correct terminology where appropriate to avoid confusion.

#### 2.7.3.4 Example

Figure 6 provides an example of a repo deal. A bank has in portfolio a LCC10 million NCD of another bank that it is holding in order to make a capital profit when rates fall. The NCD had 360 days to maturity when it was purchased. It is now day 30 in the life of the NCD (i.e. it has 330 days to run), and the bank needs funding for a particular deal that has 70 days to run. The bank sells the NCD to a party that has funds available for 70 days under agreement to repurchase the same NCD after 70 days. The rate agreed is the market interest rate for 70 days.

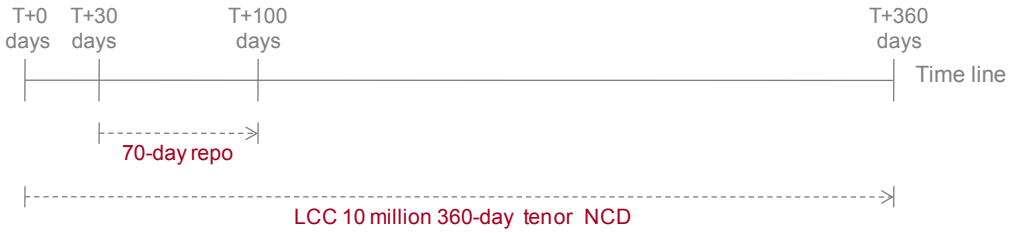


**Figure 6:** example of 70-day repo in NCDs

#### 2.7.3.5 Motivation for repos

One of the main reasons which give rise to repos is best described by way of an example. A client of a broker-dealer may wish to invest LCC50 million for a 7-day period. If the broker-dealer cannot find a seller of securities with a term of 7 days, he will endeavour to find a holder of securities who requires funds for this period. If the rate for the repurchase agreement can be agreed, the broker would effect a *resale agreement* with the seller of the securities and a *repurchase agreement* with the buyer.

Another way of putting this is that the seller is having the broker *carry* his securities for a period, while the broker is having these same securities *carried* by the buyer for the same period. Another reason which gives rise to repurchase agreements is holders of securities requiring funds for short-term periods.

Yet another transaction that gives rise to a repo is the taking of a *position* in a security. For example, a speculator who believes that bond rates are about to fall (say in the next week) would buy, say, a 5-year bond to the value of, say, LCC5 million at the spot rate of, say, 9.5% (the consideration of course will not be a nice round amount). He does not have the funds to undertake this transaction, but has the creditworthiness to borrow this amount in the view of a broker-dealer. The speculator would thus immediately sell the bond to the broker-dealer (who is involved in the repo market) for 7 days at 10.2% pa (the rate for 7-day money). The broker-dealer in turn would on-sell the bond to, say, a pension fund for 7 days at, say, 10.0% pa.

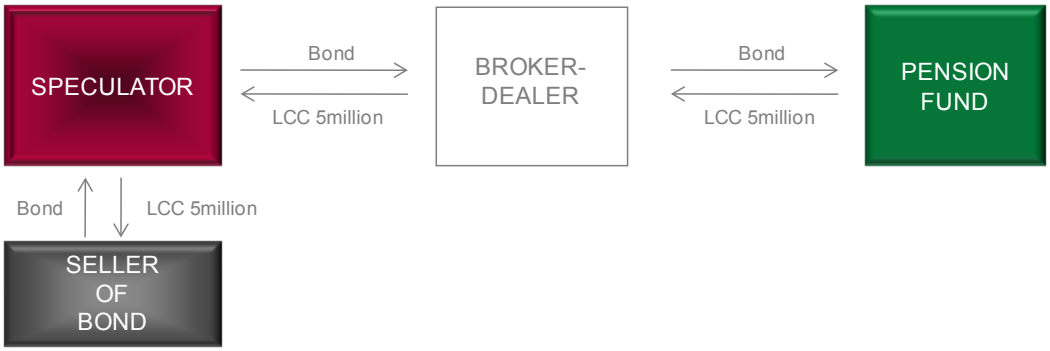


**Figure 7:** cash and security flows at onset of repo

Assume now that the 5-year bond rate falls to 9.4% on day seven. The broker-dealer unwinds the repo deal and pays the pension fund LCC5 million plus interest at 10% for 7 days (LCC5 000 000 × 7 / 365 × 0.10 = LCC9 589.04). The broker-dealer then sells the bond back to the speculator for LCC5 million plus interest at 10.2% (LCC5 000 000 × 7 / 365 × 0.102 = LCC9 780.82). The broker's profit is 0.2% on LCC5 million for 7 days (i.e. the difference between the two above amounts (LCC191.78). The speculator sells the bond in the bond market at 9.4% (remember he bought it at 9.5%). His profit on the 5-year-less-7-days bond is 0.1% (which is probably around LCC50 000 – we assume this), i.e. the consideration on the bond is LCC5 000 000 + LCC50 000 = LCC5 050 000. His overall profit is thus LCC50 000 minus the cost of the *carry* (LCC9 780.82), i.e. LCC40 219.18.

This deal may be depicted as in Figures 7–8.

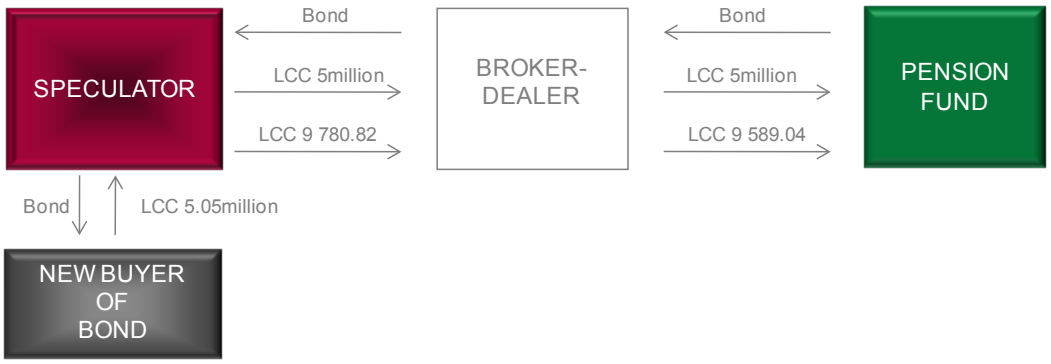


**Figure 8:** cash and security flows on termination of repo

It will be evident that the speculator sold his bond position to the broker under *repurchase agreement* for 7 days (or had them *carried* for this period). The broker did a *resale agreement* for 7 days with the speculator (or *carried* the bonds), and a *repurchase agreement* with the pension fund (or had the bonds *carried* by the pension fund). The pension fund did a *resale agreement* with the broker, or *carried* the bonds for 7 days.

Another rationale for the repo market is the interbank market. This is covered in the following section.

#### 2.7.3.6 Institutions involved in the repo market

The above are the main reasons that give rise to repurchase agreements, i.e. a party wishing to acquire funds for a period and a party with a matching investment requirement. And there are many strategies that underlie these agreements.

In Local Country (LC) the parties involved in this market are the money market broker-dealers, the banks, corporate entities, pension funds, insurance companies, money market funds, the central bank, foreign investors, speculators in the bond market, etc.

Of all these institutions, the central bank and the banks are usually the largest participants, because the *repo* is the method used by the central bank to provide accommodation to the banks (in most countries) (see below).

#### 2.7.3.7 Types of repurchase agreements

As noted earlier, there are two main types of repurchase agreements, i.e. the *open repurchase agreement* and the *fixed term repurchase agreement*. The former agreement is where there is no agreed termination date. Both parties have the option to terminate the agreement without notice. The rate on these agreements is usually a floating rate, the basis of which is agreed in advance.

Fixed term repurchase agreements are repurchase agreements where the rate and the term are agreed at the outset of the agreement. The term of repos usually range from a day to a few months.

#### 2.7.3.8 Securities that underlie repos

Only prime marketable securities are used in repos, and this includes money market and bond market securities. Repos are usually done at market value of the underlying securities or lower than market value, and the securities are *rendered negotiable*. Securities are rendered negotiable to protect the investor against the maker of the repo, i.e. in the event of the maker reneging on a deal, the investor has the right to sell the underlying securities (in terms of the ISDA Master Repurchase Agreement).

What is meant by *rendered negotiable* is that the underlying securities are prepared in negotiable form. For example, a bank acceptance made payable to a particular investor is endorsed in blank. In the case of bond certificates this means that a signed securities transfer form accompanies each certificate.[11]

#### 2.7.3.9 Mathematics of the repurchase agreement market

Repurchase agreements are dealt on a yield basis, i.e. the interest rate is paid on an add-on basis. The amount of interest is calculated in terms of the following formula:

$$IA = C \times ir \times t$$

where

IA = interest amount
C = consideration (i.e. the market value or lower of the securities)
ir = agreed interest rate per annum expressed as a unit of 1
t = term of the agreement, expressed in days / 365

If, for example, LCC10 million (nominal value) NCDs with a maturity value of LCC10 985 000, and a market value of LCC10 300 000, were sold for seven days at a repo rate of 12.0% pa, the interest payable would be as follows:

$$IA = C \times ir \times t$$
$$= LCC10\ 300\ 000 \times 0.12 \times 7 / 365$$
$$= LCC23\ 704.11.$$

It should be clear that the buyer would pay LCC10 300 000 for the repo and receive LCC10 323 704.11 upon termination of the agreement.

The mathematics of repos in the case of bonds is similar to that of bond forwards (remember a repo is a *combination of a spot sale and a forward purchase*). The carry rate is applied to the all-in price at the first settlement date of the deal (called reference price) to determine the price at termination (second settlement date).

**2.7.3.10 Repos and the banking sector**

Because the banks are the largest initiators of repos, and a large slice of the market takes place between banks, it is necessary to afford this sector a separate section.

Because repos are one method through which banks are able to acquire funding, many central banks require banks to report *on balance sheet* all their repos, for purposes of their capital adequacy requirement, i.e. banks are required to allocate capital to this activity (because the asset has to be bought back). It will be evident that if a bank brings back on balance sheet securities sold, it has to create a liability, and this liability item is termed "loans under repurchase agreements".

There are many reasons for banks engaging in the repo market. Perhaps the most prominent is that the repo instrument is a convenient method to satisfy wholesale clients' needs (retail clients do not feature in this market).

All the major banks have Treasury Departments, and this department is the hub of these banks. All wholesale transactions and portfolio planning take place in the Treasury Department. If a large mining house client, for example, would like to purchase LCC100 million securities that have 63 days to run (because it need the funds for an acquisition in 63 days' time and is "full"[12] in terms of its limit for the bank), the bank is able to satisfy the client's investment requirement by selling LCC100 million of its strategic holding of government bonds to the client for 63 days.

Another example is a small bank losing a LCC100 million deposit at the end of the trading day, and not being able to negotiate a deposit to fund the shortfall with the non-bank sector. Assuming a large bank has a LCC100 million surplus, and that this bank does not want to be exposed to the small banks, it may offer the LCC100 million to the small bank against a repo, i.e. the small bank will sell securities to the value of LCC100 million to the large bank for a day or two (at the rate for this period). Clearly, if the small bank fails in this period, the large bank has claim to the repo securities.

In most countries banks are accommodated by the central bank effecting repos with them, i.e. the banking sector sells eligible securities to the central bank under repo. The style of monetary policy adopted in most countries is ensuring that the banks are indebted to the central bank at all times (i.e. borrow cash reserves on a permanent basis), in order to "make the KIR effective".

#### 2.7.3.11 Listed repurchase agreements

Generally speaking, the repo market is an OTC market. However, in many countries repos on bonds are widely-used instruments; thus listed repos do exist.

### 2.7.4 Forward rate agreements

**General**

A *forward rate agreement* (FRA) is an agreement that enables a user to hedge itself against unfavourable movements in interest rates by fixing a rate on a notional amount that is (usually) of the same size and term as its exposure that starts sometime in the future. It is akin to a foreign exchange forward contract in terms of which an exchange rate for a future date is determined upfront.

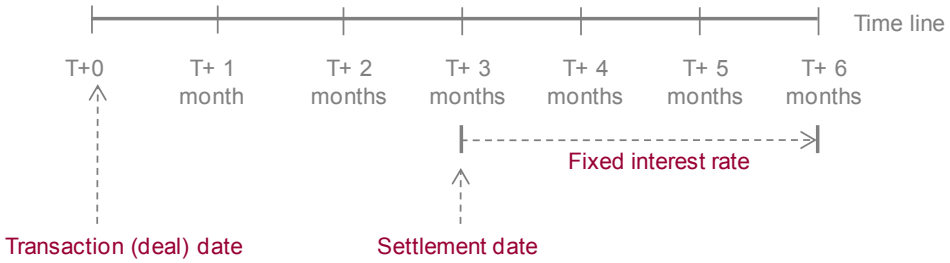


**Figure 9:** 3 × 6 FRA

An example is a 3 × 6 FRA (3-month into 6-month): the 3 in the 3 × 6 refers to 3 months' time when settlement takes place, and the 6 to the expiry date of the FRA from deal date, i.e. the rate quoted for the FRA is a 3-month rate at the time of settlement. This may be depicted as in Figure 9.

This type of instrument is particularly useful for the company treasurer who is of the opinion that the central bank is about to increase the KIR and that the interest rates on commercial paper (his borrowing habitat) will rise sharply. He needs to borrow LCC20 million in three months' time for a period of three months. He approaches a dealing bank that he normally deals with on 4 March and obtains quotes on a series of FRAs as shown in Table 1[13].

| FRA | Bid (% pa) | Offer (% pa) | Explanation |
|---|---|---|---|
| 3 × 6 | 10.00 | 10.10 | 3-month rate in 3 months' time |
| 6 × 9 | 10.20 | 10.30 | 3-month rate in 6 months' time |
| 9 × 12 | 10.40 | 10.50 | 3-month rate in 9 months' time |

**Table 1:** fictional fra quotes

The treasurer verifies these rates against the quoted FRA rates of another two banks (i.e. to ensure that he is getting a good deal), finds that they are fair and decides to deal at the 10.10% pa offer rate for the 3 × 6 FRA for an amount of LCC20 million, which matches the company's requirement perfectly. The applicable future dates are 4 June and 3 September (91 days).

The transaction means that the dealing bank undertakes to fix the 3-month borrowing rate in three months' time at 10.10% for the company. The transaction is based on a *notional amount* of LCC20 million. The notional amount is not exchanged; it merely acts as the amount upon which the calculation is made.

The rate fixed in the FRA is some *benchmark* (also called *reference*) rate, or a rate referenced on a benchmark rate, i.e. some rate that is readily accepted by market participants to represent the 3-month rate. We assume this is the 3-month JIBAR[14] rate, which is a yield rate.

On settlement date, i.e. 4 June, the 3-month JIBAR rate is 10.50% pa. On this day the 3-month (91-day) commercial paper rate is also 10.50% pa (which it should be because the JIBAR rate is representative of the 3-month rate). The company borrows the LCC20 million required at 10.50% through the issue of commercial paper for 91 days. According to the FRA the dealing bank now owes the company an amount of money equal to the difference between the spot market rate (i.e. 3-month JIBAR = 10.50% pa) and the agreed FRA rate (i.e. 10.10% pa) times the notional amount. This is calculated as follows:

$$SA = NA \times ird \times t$$

where

SA = settlement amount
NA = notional amount
ird = interest rate differential (10.50% pa – 10.10% pa = 0.40% pa)
t = term (forward period), expressed as number of days / 365
SA = LCC20 000 000 × 0.004 × (91 / 365)
= LCC19 945.21.

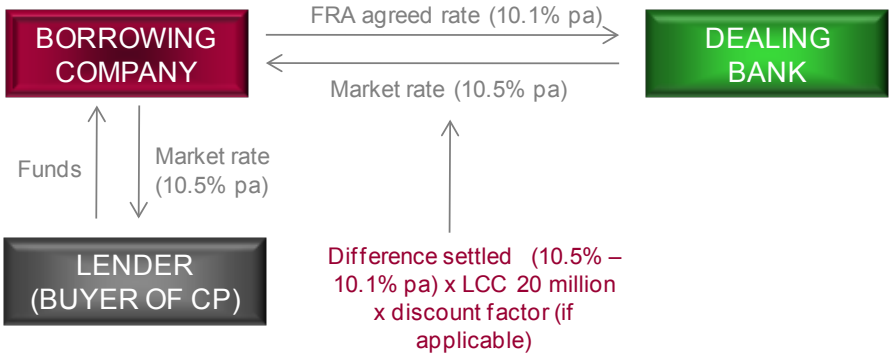


**Figure 10:** example of FRA: bank settles difference

Note that this formula applies in the case where settlement of this amount is made in arrears at month 6 (= 3 September). If the amount is settled at month 3 (= 4 June) it has to be discounted to present value (PV). The discount factor is:

df = 1 / [1 + (rr × t)]

where

rr = reference rate (= JIBAR rate)
t = term of agreement (number of days / 365)

df = 1 / [1 + (rr × t)]
= 1 / [1 + (0.105 × 91 / 365)]
= 0.97449.

Therefore (PVSA = present value of settlement amount):

PVSA = SA × df
= LCC19 945.21 × 0.97449
= LCC19 436.41

This transaction may be illustrated as in Figure 10. It will be evident that the exchange of interest on LCC20 million does not take place; the dealing bank only settles the difference.

### Implied forward rate

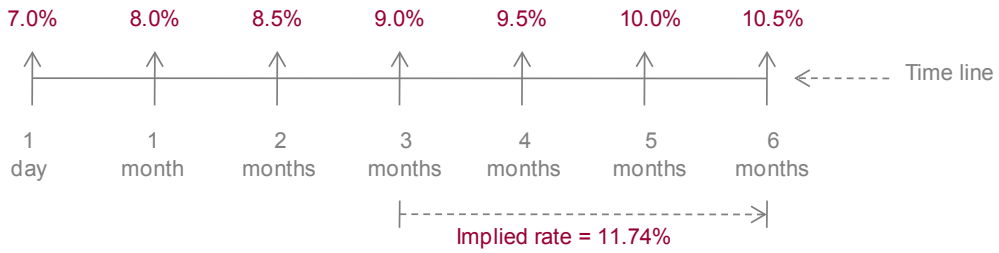


**Figure 11:** money market yield curve

The dealing bank would of course not have sucked the rates quoted out of thin air. It would have based its forward rates on the rates implicit in the spot market rates. An example is required (see Figure 11).

Shown here are the spot rates for various periods at a point in time[15]. This may also be called a money market yield curve (as opposed to a long-term yield curve which stretches for a number of years). This notional yield curve may also be depicted as in Figure 12 (this is an unrealistic yield curve, because the yield curve does not usually follow straight lines).

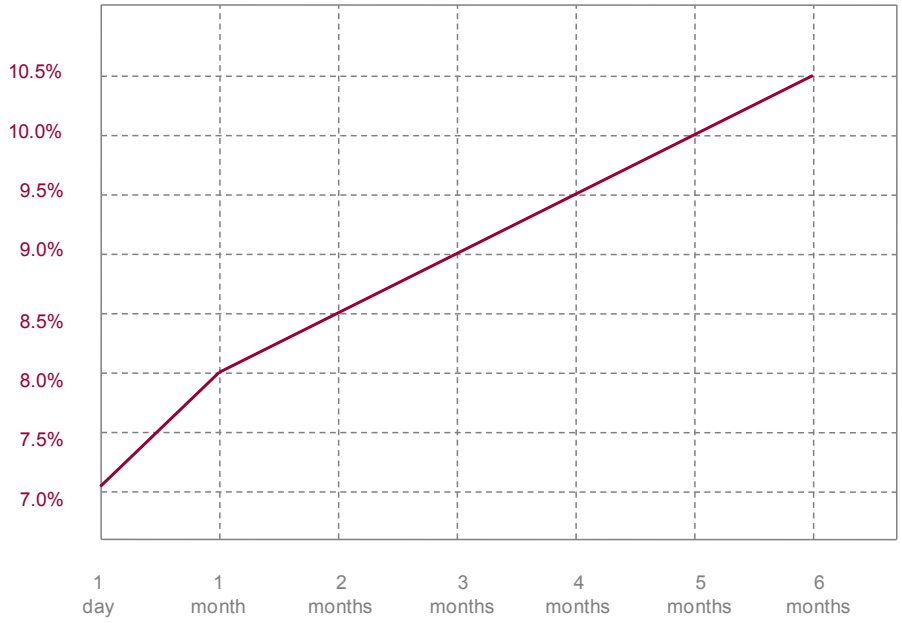


**Figure 12:** fabricated money market yield curve

The rate now (spot rate) for three months is 9.0% pa and the rate now (spot rate) for six months is 10.5% pa, and we know that the latter rate covers the period of the first rate. The rate of interest for the three-month period *beyond the three-month period* can be calculated by knowing the two spot rates mentioned. This is the forward rate of interest, or the *implied forward rate*. This is done as follows (assumption 3-month period: 91 days; 6-month period: 182 days):

$$IFR = \{[1 + (ir_L \times t_L)] / [1 + (ir_S \times t_S)] - 1\} \times [365 / (t_L - t_S)]$$

where

$IFR$ = implied forward rate
$ir_L$ = spot interest rate for the longer period (i.e. 6-month period)
$ir_S$ = spot interest rate for shorter period (i.e. 3-month period)
$t_L$ = longer period, expressed in days / 365) (i.e. the 6-month period – 182 days)
$t_S$ = shorter period, expressed in days / 365) (i.e. 3-month period – 91 days)

$$IFR = \{[1 + (0.105 \times 182/365)] / [1 + (0.09 \times 91/365)] - 1\} \times 365/91$$
$$= [(1.0524 / 1.0224) - 1] \times 365/91$$
$$= (1.0293 - 1) \times 365/91$$
$$= 0.1174$$
$$= 11.74\% \text{ pa.}$$

The bank, in the case of a 3 × 6 FRA, will quote a rate that is *below* the implied 3-month forward interest rate, i.e. below 11.74%.

## 2.8 Forwards in the share / equity market

There is only one type of forward contract in the share market, and this is the outright forward. An outright forward is simply the sale of shares at some date in the future at a price agreed at the time of doing the deal. The mathematics is straightforward (= cost of carry model):

$$FP = SP \times [1 + (ir \times t)]$$

where

FP = forward price
SP = spot price
t = term, expressed as number of days / 365
ir = interest rate per annum for the term (expressed as a unit of 1).

An example is required: a pension fund believes the price of Company XYZ shares will increase over the next 85 days when its cash flow allows the purchase of these shares. It requires 100 000 shares of the company and approaches a broker-dealer to do an 85-day forward deal. The broker-dealer buys the 100 000 shares now at the spot price of LCC94 per share and finances them by borrowing the funds from its banker at the prime rate of 12.0% pa for 85 days. It offers the pension fund a forward deal based on the following (assumption: non-dividend paying share):

SP = 100 000 shares of Company XYZ at LCC94.0 per share = LCC9 400 000
t = 85 days
ir = 12.5% = 0.125 (note that the it includes a margin of 0.5%)
FP = LCC9 400 000 × [1 + (0.125 × 85 / 365)]
= LCC9 400 000 × 1.029110
= LCC9 673 634.00.

After 85 days the pension funds pays the broker-dealer this amount for the 100 000 Company XYZ shares, and the broker-dealer repays the bank:

Consideration = LCC9 400 000 × [1 + (0.12 × 85 / 365)]
= LCC9 400 000 × 1.027945
= LCC9 662 684.92.

The broker-dealer makes a profit of LCC10 949.07 (LCC9 673 634.00 – LCC9 662 684.92).

Clearly, the pension fund at the start of the deal is of the opinion that the price of the shares will increase by more than the price of money for the period. Pension funds mainly do outright forward share transactions and this is because they are not permitted to incur borrowings. The pension fund would also "shop around" to find the best deal.

## 2.9 Forwards in the foreign exchange market

### 2.9.1 Introduction

Foreign exchange is deposits and securities in a currency other than the domestic currency, and an exchange rate is an expression of units of a currency in terms of one unit of another currency. An example is USD / LCC 7.5125, which means that LCC 7.5125 is required to buy USD 1.0[16]. The 1.0 is left out of the expression because it is known to be 1.0. The one unit currency is called the *base currency* and the other the *variable currency*.

There are two broad types of deals in foreign exchange, spot and forward, and there are four types of forwards. The five deal types in foreign exchange are:

- Spot foreign exchange transactions.
- Forward foreign exchange transactions:
  - Outright forwards
  - Foreign exchange swaps (not to be confused with "proper" currency swaps)
  - Forward-forwards
  - Time options (not to be confused with "normal" options).

A *spot foreign exchange transaction* is a deal done now (on T+0) for settlement on T+2 (an international convention), and essentially amounts to the exchange of bank deposits in two different countries. Investments or the purchase of goods then occur as a second phase, i.e. the foreign bank deposit is used to buy the foreign investment or goods. A *forward foreign exchange transaction* is a transaction that takes place (i.e. is settled) on a date in the future other than the spot settlement date of T+2, but the price and amount is agreed on the deal date (i.e. now = T+0). This transaction is called an outright forward. This type of forward foreign exchange transaction and the other slight variations on the main theme are discussed next.[17]

### 2.9.2 Outright forwards

#### 2.9.2.1 Introduction

As noted, *outright forwards* are forward foreign exchange contracts, i.e. contracts between the market making banks[18] 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. The formula is:

$$\text{Outright forward} = SP \times \{[1 + (ir_{vc} \times t)] / [1 + (ir_{bc} \times t)]\}$$

where

SP = spot exchange rate
$ir_{vc}$ = interest rate on variable currency
$ir_{bc}$ = interest rate on base currency
t = term, expressed as number of days / 365.

The above is the standard formula, because the vast majority of forwards are done for standard periods of less than a year (30-days, 60-days, 90-days, 180-days, etc). When the period is longer than a year, the formula becomes:

Outright forward $= SP \times [(1 + ir_{vc})^n / (1 + ir_{bc})^n]$
where n = number of years

(where the period is broken years, for example 430 days, then n = 430 / 365).

It will have been noted that the principal here is the PV / FV concept, with the difference being that there are two interest rates that are to be taken into account. If the rate on the variable currency is higher than the rate on the base currency, then the units of the variable currency will be higher, i.e. it takes more LCC to buy one USD on a forward date. Conversely, it takes less USD to buy one LCC on the forward date. An example is called for.

#### 2.9.2.2 Example one

Forward period = 60 days
Spot rate = USD / LCC 7.50
$ir_{bc}$ = 5.0%pa
$ir_{vc}$ = 10.0% pa

Outright forward rate[19]

$= SP \times \{[1 + (ir_{vc} \times t)] / [1 + (ir_{bc} \times t)]\}$
$= 7.50 \times \{[1 + (0.10 \times 60/365)] / [1 + (0.05 \times 60/365)]\}$
$= 7.50 \times (1.01643836 / 1.00821918)$
$= 7.56114134$
= USD / LCC 7.56114134.

Let us test the logic. An investor has the choice of investing in a LCC 60-day deposit at 10.0% pa or in a USD 60-day deposit at 5.0% pa. In the former case the investor will earn (assuming LCC 10 000 000 is available to invest):

Forward consideration $=$ present consideration $\times [1 + (ir_{vc} \times 60/365)]$
$=$ LCC 10 000 000 $\times [1 + (0.10 \times 60/365)]$
$=$ LCC 10 000 000 $\times$ 1.01643836
= LCC 10 164 383.60

In the latter case the investor buys the USD equivalent of LCC 10 000 000 = USD 1 333 333.33 [LCC 10 000 000 × (1 / 7.5)]. The investor immediately deposits this amount for 60 days at 5.0% pa, and sells the USD forward consideration forward for LCC at the forward rate of USD / LCC 7.56114134:

$$\begin{aligned}\text{Forward consideration} &= \text{present consideration} \times [1 + (ir_{bc} \times 60/365)] \\ &= \text{USD } 1\,333\,333.33 \times [1 + (0.05 \times 60/365)] \\ &= \text{USD } 1\,333\,333.33 \times 1.00821918 \\ &= \text{USD } 1\,344\,292.23.\end{aligned}$$

LCC equivalent at forward exchange rate:

$$\begin{aligned}&= \text{USD } 1\,344\,292.23 \times 7.56114134 \\ &= \text{LCC } 10\,164\,383.60.\end{aligned}$$

It should be evident that the forward exchange rate may be calculated by dividing the LCC forward consideration by the USD forward consideration:

$$\text{LCC } 10\,164\,383.60 / \text{USD } 1\,344\,292.23 = 7.5611.$$

Conclusion: the investor earns the same return in both countries, and this is so because of the principle of *interest rate parity*:

*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. In this example USDs are selling at a premium in the forward market (think: *more LCC per USD in the forward market*).

This condition in the forward market is brought about by arbitrage. The many participants in the foreign exchange market seek out arbitrage opportunities in this regard (mispricing) and drive the forward exchange rate to reflect the condition of *interest rate parity.*

In the above example the spot exchange rate was USD / LCC 7.5 and the forward exchange rate USD / LCC 7.5611 (rounded). Thus the *forward points* (or forward *swap* points) are 611 (or LCC 0.0611). This is clarified in the following section on foreign exchange swaps.

#### 2.9.2.3 Example two

It will be useful to provide another example in order to clarify the PV/FV concept:

A citizen of Local Country borrows funds for 6 months from a Local Country bank, buys USD at the spot rate, invests immediately in a 60-day USD deposit, and converts the USD forward consideration into LCC at the forward rate. The elements of the transactions are:

| | |
|---|---|
| Amount borrowed | = LCC 10 000 000 at 10% pa |
| LCC borrowing rate | = 10.0%pa |
| Spot exchange rate | = USD / LCC 7.5 |
| USD 6-month deposit rate | = 5% pa |
| Forward exchange rate | = 7.56114134. |

| | |
|---|---|
| LCC 10 000 000 at spot rate | = USD 1 333 333.33 (LCC 10 000 000 / 7.5) |
| USD 1 333 333.33 at 5% for 60 days | |
| | = USD 1 333 333.33 × (1 + 0.05 × 60 / 365) |
| | = USD 1 333 333.33 × 1.0082192 |
| | = USD 1 344 292.26 |
| USD 1 344 292.26 sold for LCC at forward rate | |
| | = USD 1 344 292.26 × 7.56114134 |
| | = LCC 10 164 384 |

LCC owed to bank after 60 days

$$= \text{LCC } 10\,000\,000 \times (1 + 0.10 \times 60 / 365)$$
$$= \text{LCC } 10\,000\,000 \times 1.01643834$$
$$= \text{LCC } 10\,164\,384.$$

It will be clear that the Local Country LCC borrower / USD investor did not benefit from the deal; he is at break-even. Had he benefited the forward rate would have been out of line, allowing an arbitrage deal to be undertaken.

From this example it will have been established that if the cost of borrowing is higher than the gain from lending the forward rate will have to be at a premium to compensate for the interest rate differential. It may also be explained as follows:

*If LCC invested increases by more than USD invested (because of the higher LCC interest rate), the numerator (LCC) will increase by more than the denominator (USD) and thus result in a forward rate that is higher than the spot rate.*

The numerator and denominator referred to are of course from the formula presented above and repeated here:

$$\text{Outright forward exchange rate} = SP \times \{[1 + (ir_{vc} \times t)] / [1 + (ir_{bc} \times t)]\}.$$

### 2.9.3 Foreign exchange swaps

*Foreign exchange swaps* (called *forex swaps* or just *swaps*) are not to be confused with "proper" currency swaps, which will be covered later. Forex swaps are forward deals done on a different basis, and are the deal type done by the market maker banks in the vast majority of cases.

A forex swap is the exchange of two currencies now (i.e. spot) at a *specified* 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 on which the "points" are based) coupled with an agreement to exchange the same 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. This quote is interpreted as follows:

- the left side (specified exchange rate + 590 points) is the rate at which the quoting bank will buy USD in 60 days for USD sold spot now (client buys spot and sells forward)
- the right side (specified exchange rate + 600 points) is the rate at which the quoting bank will sell USD after 60 days for USD bought spot now (client sells spot and buys forward).

It is important to note that the points run from the second decimal and are in terms of price (of the variable currency). The following should be clear:

| | |
|---|---|
| Forward swap | = outright forward – SP |
| Outright forward | = SP + forward swap |

Using the earlier numbers:

| | |
|---|---|
| Forward swap | = outright forward – SP |
| | = 7.5611 – 7.5 |
| | = 0.0611 |
| Outright forward | = SP + forward swap |
| | = 7.5 + 0.0611 |
| | = 7.5611. |

An example is called for: a number of years ago the Local Country central bank encouraged the inflow of foreign exchange by offering the banks cheap swap rates. This means that the local banks were "encouraged" to borrow offshore and swap USD for LCC, which is unwound on the forward date, giving them a virtually risk-free profit. The following are the numbers (utilising some of the numbers used earlier):

| | |
|---|---|
| Specified rate (= spot rate = SP) | = USD / LCC 7.5 |
| Period of forward deal | = 60 days |
| Interest rate parity forward rate | = USD / 7.5611 (i.e. "fair value" rate) |
| USD rate (assume borrowing in US) ($ir_{bc}$) | = 5.0% pa |
| LCC rate (assume lending in LC) ($ir_{vc}$) | = 10.0% pa |
| Forward points offered | = 550. |

A local bank borrows USD 1 000 000 at 5.0% from a US bank and sells this to the Local Country central bank. The central bank credits the bank's current account in its books (i.e. excess cash reserves) by LCC 7 500 000 (USD 1 000 000 × 7.5). This of course amounts to the *exchange of currencies in the first round of the swap*. The central bank undertakes to exchange USD 1 000 000 plus interest at 5% for LCC in 60 days' time (the second exchange) at the forward rate of:

Forward rate = specified rate (the benchmark rate) + forward swap points
= 7.50 + 550 (i.e. 0.0550)
= 7.555

Forward consideration (USD) = borrowing × [1 + ($ir_{bc}$ × 60/365)]
= USD 1 000 000 × [1 + (0.05 × 60/365)]
= USD 1 000 000 × 1.008219
= USD 1 008 219.

This means that the central bank will supply USD 1 008 219 at an exchange rate of USD / LCC 7.555 at the conclusion of the swap after 60 days.

The bank withdraws the *created*[20] LCC7 500 000 from the central bank and invests this in a local bank (other bank most likely) NCD at 10.0%. The proceeds at the end of the forward period are:

Forward consideration (LCC) = deposit × [1 + ($ir_{vc}$ × 60/365)]
= LCC 7 500 000 × [1 + (0.10 × 60/365)]
= LCC 7 500 000 × 1.01643836
= LCC 7 623 288.

On the due date of the swap, the central bank supplies USD 1 008 219 to the local bank for a LCC 7 617 095 (USD 1 008 219 × 7.555)[21]. This of course amounts to the *exchange of currencies in the opposite direction, ie it is the second round of the swap*. The local bank fulfils its obligation to the US bank (USD 1 008 219 = borrowing plus interest), and pockets the profit on the swap of LCC 6 193. This amount is the difference between the amount paid by the bank that issued the NCD and the amount paid by the bank to the cin terms of the swap contract (LCC 7 623 288 – LCC 7 617 095).

### 2.9.4 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 (now = T) and 90 days from deal date. The backdrop to this deal may be that the client (company) previously bought USD forward (30 days' ago 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[22] is illustrated Figure 13.

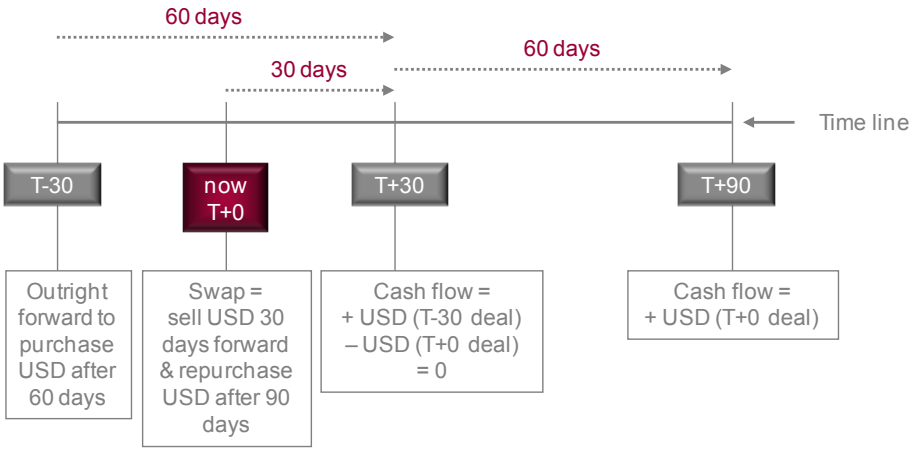


**Figure 13:** example of a forward-forward deal

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.[23]

### 2.9.5 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 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 (e.g. an importer), or to be sold (e.g. 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 future date and the expiry date of the contract.

A forex time option is not to be confused with a *currency option* in terms of which the holder 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.*

### 2.9.6 Functions/uses of the forward foreign exchange market

There are many reasons for the existence of the forward foreign exchange market, but it is 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.

## 2.10 Forwards in the commodities market

Above we have discussed the forward markets in the debt market and the foreign exchange market. There are also forward markets in many commodities, but they will not be discussed here, because the principle remains the same. Only the maths is slightly different because other costs, such as storage (which usually includes insurance), is taken into account:

$$FP = \{SP \times [1 + (ir \times t)]\} + (SC \times dte)$$

where

FP = forward price
SP = spot price
ir = interest rate for period, i.e. period from now to the forward deal date
dte = days to expiry (of forward contract, i.e. until forward deal date)
t = dte / 365
SC = storage costs.

It will be evident that this is a "carry cost" (CC) model, where there are two costs, interest and storage, and no income on the asset is forthcoming (if income were forthcoming the model becomes a "net carry cost" (NCC) model.

*Example: forward grain market: one ton of grain will be delivered to a buyer 91 days from today:*

SP (of grain) = LCC1 200 per ton
ir = 12.0% pa
dte = 91
t = 91 / 365
SC = 35 cents per ton per day
FP = {LCC1 200 × [1 + (0.12 × 91 / 365)]} + (0.35 × 91)
= (LCC1 200 × 1.0299) + LCC31.85
= LCC1 267.75 per ton.

## 2.11 Forwards on derivatives

In addition to the forwards that are found in the four financial markets, there are also forwards on swaps.

The specific swaps on which forwards are written are interest rate swaps (IRSs). The forward IRS is an agreement to enter into a swap at some stage in the future at terms agreed upfront. It differs from a swaption (discussed later) in terms of which the holder has the right to allow the option to lapse. In the case of a forward swap, the *holder is obliged to undertake the swap* at the future agreed date (swaps are discussed in some detail later).

## 2.12 Organisational structure of forward markets

Figure 14 is one way of depicting the organisational structure of the spot financial markets.

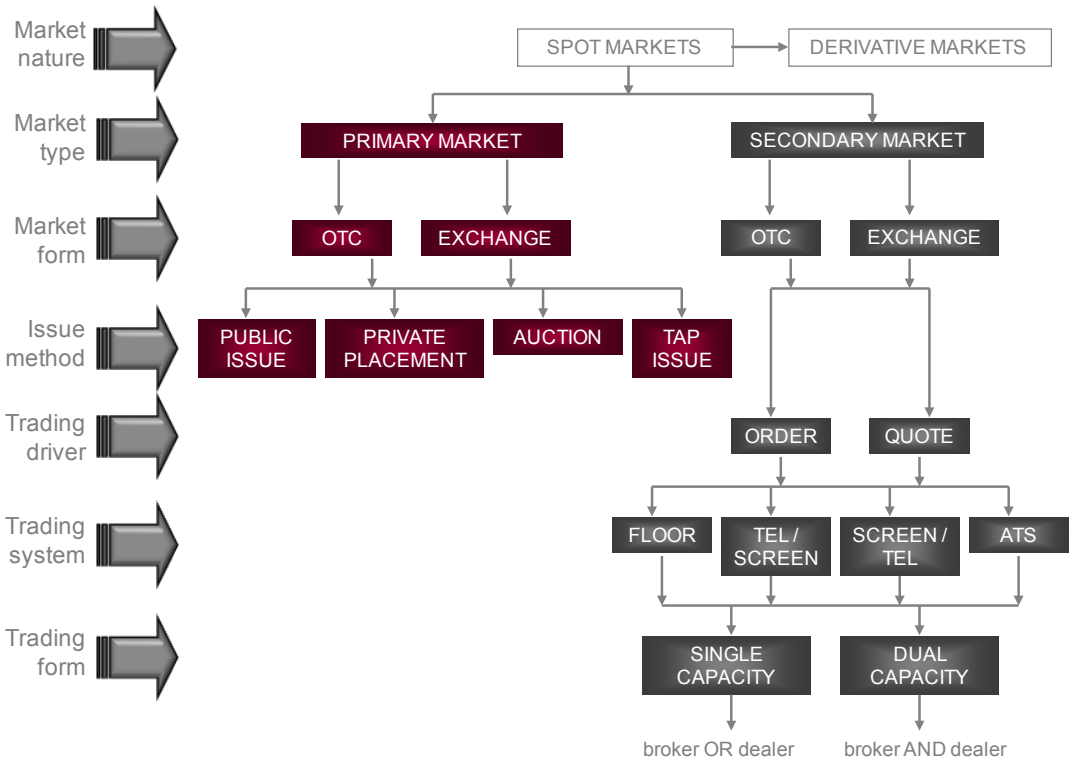


**Figure 14:** organisationalstructure of spot financial markets

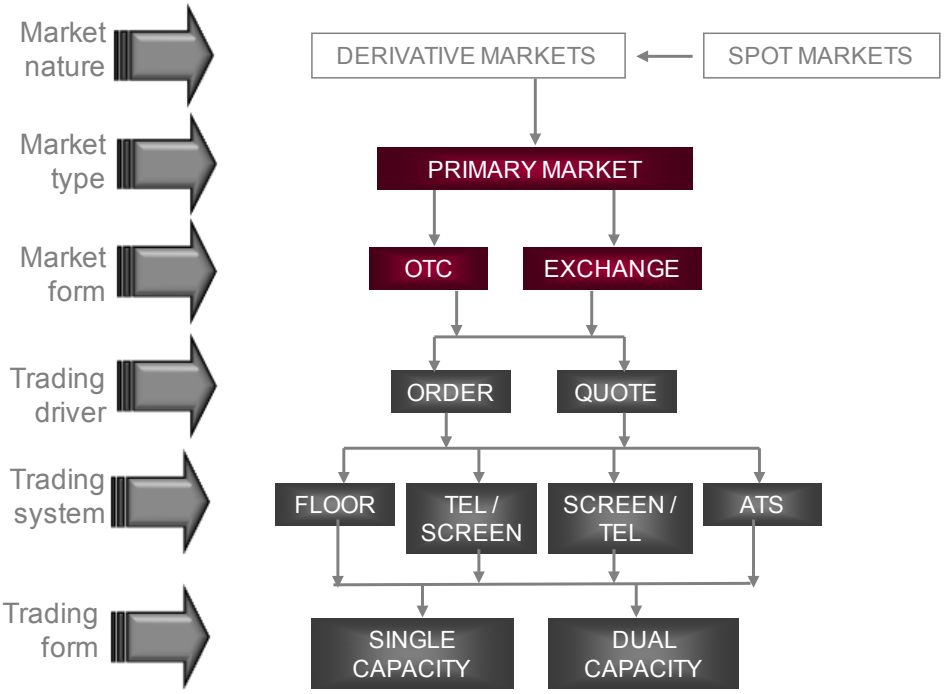


**Figure 15:** organisationalstructure of derivative financial markets

However, this applies to the "normal" financial markets, i.e. the money, bond and share markets. It is not well suited to the foreign exchange and derivative markets. Figure 15 is an attempt to visualise the derivative markets.

The derivative markets in the form of the OTC forward markets are entirely primary markets (there are minor exceptions such as repos that are marketable, but trading in them is rare); thus, generally, one cannot talk of a secondary OTC derivatives market (in the normal sense of the term). The reason for this situation is that the forward market instruments are usually custom made for clients. However, this does not mean that the holder of a forward transaction is "stuck" with the deal until maturity; the instruments are "marketable" in the sense that the positions created by them may be "closed out" quite easily by the purchase / sale of an opposite deal. The "closing out" will result a net loss or profit, as in the case of a spot instrument sale.

The same applies in the case of listed (on an exchange) forwards, but with a difference. A secondary market in these listed instruments also does not exist in the normal sense of the term. However, the contracts are standardised and can therefore be "closed out" by doing an equal but opposite transaction. In the case of the OTC forward markets it is not always possible to do the exact opposite transaction, leaving thus a measure of risk.

This brings us to the trading driver: quote or order. Participants are able to get quotes from the banks or place an order with a broker-dealer. "Quote" means that the banks provide quotes (as in market making – explained earlier). This leads to the trading system. In the Local Country's derivative markets, all the trading systems apply (except "floor"; it does however still apply in some international markets).

The trading system "telephone / screen" means applies where broker-dealers quote indication prices on the screen (for example, the Reuters Monitor System) and clients phone in and ask for firm prices. "Screen / telephone" is where prices quoted on screen are firm for a certain size deal and the deal is consummated on the telephone. ATS stands for "automated trading system" and here deals in the form of orders are inputted into the ATS and are matched by it if there is an opposite order. The various types of forward transactions fit into one of these three trading systems.

Single and dual capacity trading means that the broker-dealers either act as brokers *and* dealers (dual) or as brokers *or* dealers (single).

## 2.13 Summary

Forward contracts are to settle assets / securities on dates in the future other than spot settlement dates. Some markets are suited for forward contracts such as the forex market and the FRA market. There are forwards in all the markets: debt, share, forex and commodities. The pricing of forwards rests on the cost of carry model, i.e. the rate of interest for the relevant period less income (if applicable).

## 2.14 Bibliography

Bodie, Z, Kane, A, Marcus, AJ, 1999. **Investments**. Boston: McGraw-Hill/Irwin.

Faure, AP, 2005. **The financial system**. Cape Town: QUOIN Institute (Pty) Limited.

Hull, JC, 2000. **Options, futures, & other derivatives** (4e). London Prentice-Hall International, Inc.

McInish, TH, 2000. **Capital markets: A global perspective**. Massachusetts, USA: Blackwell Publishers Inc.

Mishkin, FS and Eakins, SG, 2000. **Financial markets and institutions** (3e). Reading, Massachusetts: Addison-Wesley.

Rose, PS, 2000. **Money and capital markets** (international edition). New York: McGraw-Hill Higher Education.

SAFEX (Financial Derivatives and Agricultural Products Divisions of the JSE Securities Exchange South Africa), 2003. [Online]. Available: www.safex.co.za. [Accessed October].

Saunders, A, 2001. **Financial markets and institutions** (international edition) New York: McGraw-Hill Higher Education.

Santomero, AM and Babbel, DF, 2001. **Financial markets, instruments and institutions** (2e). Boston:. McGraw-Hill/Irwin.

Spangenberg, P, 2000. Forward rate agreements. **The Southern African Treasurer.** 14. September.