Financial Markets Books

Treasury Services

IN COMPLIANCE WITH THE ESMA GUIDELINES

FX Risk Management

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Financial Markets Books
Geelvinckstraat 56, 1901 AJ Castricum

ISBN 978-9492648-03-7

Introduction

The foreign exchange market or FX market is the market on which different currencies are traded against one another. The rate at which the currency are traded is called the exchange rate or FX rate. The FX rate is, in principle, determined by supply and demand which, in turn, are determined by figures about the economy, by market sentiment and, finally, by technical analysis.

Many companies operate in an international environment. As a result they may be exposed to FX risk, which means that the development of the FX rates has an impact on their financial results. These companies can try to reduce their exposure to FX risk by trying to have both their incoming and outgoing cash flows be denominated in one and the same currency. If this is not possible, they first have to assess the level of risk that they are exposed to, next have to develop a policy how they want to deal with the risk, then have to lay down this policy in the treasury charter and, finally, they have to execute this policy by executing FX transactions such as FX spot, FX forward and FX options.

1 Terminology

With most FX transactions, the currencies are traded at the current market exchange rate and settlement takes place on a standard delivery date, usually two business days after the transaction date. These transactions are called FX spot transactions. The current market exchange rate is called the FX spot rate. FX transactions, however, can also be settled on other moments than the spot date, for instance

- on the trade day: FX transaction for *value today*
- on the first trading day following the trade day: FX transaction for *value tomorrow*
- on any other day after the spot date: FX *forward*

The exchange rate between two currencies expresses the value ratio between two currencies as a number and is stated as an is stated as an FX quotation. The currency which is mentioned firstly in an FX quotation is referred to as the trade currency or base currency (the traded good) and the currency which is mentioned secondly is referred to as the price currency or quoted currency.

In FX quotations, currencies are expressed by their ISO codes. ISO stands for International Standardization Organization. The table below shows the ISO codes for some of the most important currencies.

Currency	**ISO Code**
Euro	EUR
US dollar	USD
Chinese yuan	CNY
Pound Sterling	GBP
Japanese yen	JPY
Swiss franc	CHF

There are international conventions regarding which currency is the base currency and which currency is the quoted currency in an FX quotation. The euro is always quoted as the base currency against other currencies: EUR/USD, EUR/GBP, EUR/JPY, EUR/CHF et cetera.

The British pound and the other currencies of the Commonwealth are the base currency in all exchange rate quotations except in those cases where the euro is the counter currency. The US dollar is the base currency in most exchange rate quotations with the exception of euro and the currencies of the Commonwealth:

USD/JPY; USD/CHF; USD/CNY, however,
EUR/USD; GBP/USD; AUD/USD.

Exchange rate quotations for which these rules are properly applied are referred to as direct quoted FX rates. If these rules are not applied, for instance in the case of GBP/EUR, the quotation is called an indirect quotation.

In most exchange rate quotations, the value of one unit of the base currency is expressed as a number of units of the quoted currency. For example, if the EUR/USD spot rate is 1.1500, this means that 1 euro has the same value as 1.1500 US dollars.

Example

On 12 October 2009, the euro-dollar trader at ING Bank buys 10 million euro at spot from the euro-dollar trader at Deutsche Bank. The spot rate is 1.1425.

On 14 October 2009 (= spot value date), ING Bank must transfer an amount of USD 11,425,000 to Deutsche Bank. Deutsche Bank must, in turn, transfer an amount of EUR 10,000,000 to ING.

As is the case for all prices in the financial markets, there are bid and ask rates for the FX spot rate. The difference between the bid and ask rate is called the spread. For example, when a bank I quoting EUR/USD: 1.1530 - 1.1532, this means that he is willing to buy 1 euro for 1.1530 US dollars and to sell 1 euro for 1.1532 US dollars.

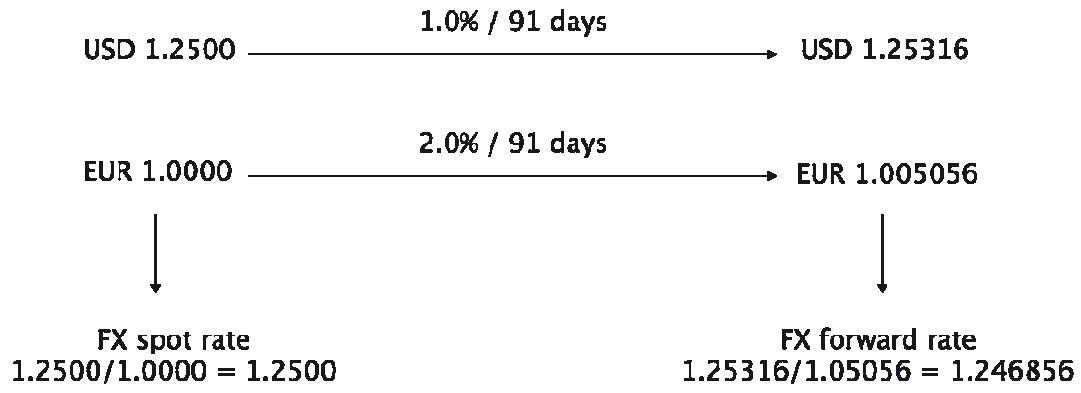
FX forward rates

We have already mentioned that the settlement date of an FX transaction can take place on a date later than the spot date. If this is the case, then the FX rate is adjusted for the delay of the settlement. The rate that is used for transactions with a settlement date later than spot is called the FX forward rate.

The FX forward rate can theoretically be calculated by calculating the future value of one unit of the base currency and of the corresponding amount of units of the quoted currency, both on the forward delivery date and by dividing the future value in the quoted currency by the future value in the trade currency.

Figure 1 shows how an FX forward rate can theoretically be calculated for a EUR/USD FX forward contract with a term of 91 days. The FX spot rate for EUR/USD is 1.2500, the three month euro interest rate is 2% and the three month US dollar interest rate is 1%.

Figure 1 Theoretical calculation of the three month forward rate EUR/USD



The future value of 1.2500 US dollars after three months (91 days) is[1]:
1.2500 x (1 + 91/360 x 0.01) = USD 1.25316 and the future value of 1.0000 euro after 91 days is 1.0000 x (1 + 91.360 x 0.02) = 1.005056

The FX forward is rate is found by dividing the future value in USD by the future value in EUR: 1.25316 / 1.005056 = 1.246856.

[1] In these types of calculation we use the actual number of calendar days

In the above example, the EUR/USD FX forward rate is 1.2469 (rounded) whereas the FX spot rate is 1.2500. The difference between the FX forward rate and the FX spot rate is 0.0031. The difference is usually expressed in forward points/ swap points. In this case: 31 swap points. The swap points express the interest rate differential between the two currencies. If the interest level in both the euro area and in the USA would be the same, then the FX forward rate would be equal to the FX spot rate and the number of swap points would be zero.

Swap points do not express an expectation about the future development of the FX sport rate, which is a common misunderstanding, and neither do they express an expectation about the future movement of the interest rates. Swap points merely express the interest differential between the two currencies on the moment that an FX forward transaction is transacted.

2 Types of FX risk

Companies can be exposed to two different types of FX risk, i.e. transaction risk and translation risk. Companies that import or export goods or services face transaction risk. This is the risk that their net income is to a more or lesser extent dependent of the development of exchange rates. A Dutch importing company that, for instance, has to pay his Japanese supplier in Japanese yen, has the risk that the Japanese yen will become stronger and, as a result, that his costs will increase. And, on the other hand, a Dutch exporting company that, for instance, has sent an invoice denominated in US dollars and, as a result, has a claim in US dollars, is faced with the risk that the US dollar will become weaker.

Companies that have foreign subsidiaries may be faced with translation risk. A Dutch company that, for instance, has a US subsidiary is required to include this subsidiary in the consolidated balance sheet for the counter value in euro of the US dollar value of the subsidiary. If the US dollar would become weaker, this means that the counter value in euro would decrease and, as a result, that the consolidated capital would decrease. Companies that have taken up or have granted loans in a foreign currency are

also faced with translation risk.

3 How to determine the level of FX risk

The FX risk that organizations run is determined by two factors: the exposure and the volatility of the FX rates. The exposure as a result of transaction risk is calculated as the net sum of outgoing and incoming payments in a specific reporting period. The exposure as a result of translation risk is the net amount of an organization's assets and liabilities in a specific foreign currency. If the exchange rates would not fluctuate, then, even if an organization would have an exposure, there would be no risk. However, usually FX rates constantly fluctuate which means that companies who have cash flows or balance sheet items that are denominated in a foreign currency run an FX risk. The extent to which FX rates fluctuate is expressed by the volatility.

Commonly the following equation is used to calculate the FX risk that an organization runs:

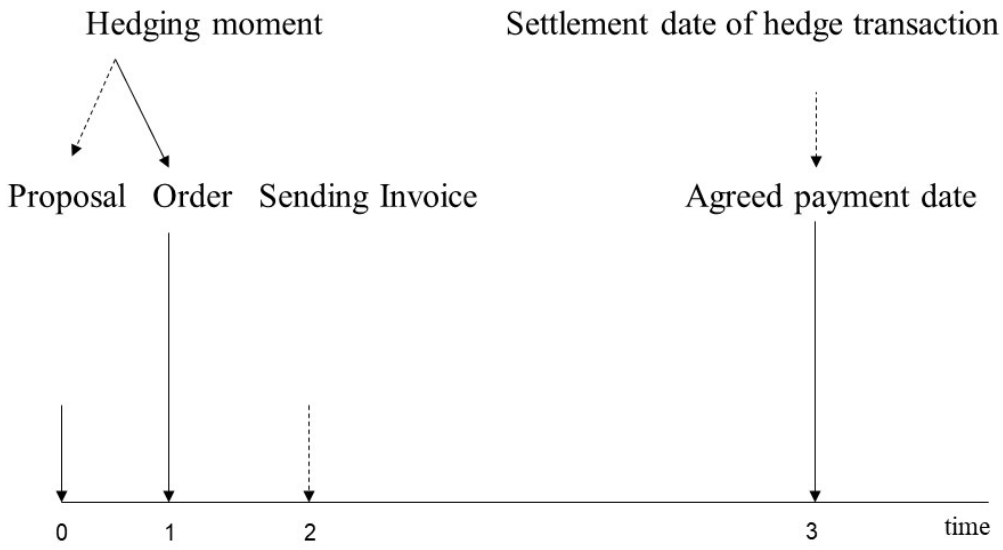
FX Risk = Net exposure x volatility

The exposure as a result of transaction risk is more difficult to determine than the exposure as a result of translation risk. There are two different types of transaction exposures: contract exposures and cash flow exposures.

3.1 Contract exposure

A contract exposure is a result of a single payment obligation or of a single claim in a foreign currency, usually as a result of a one-off import or export transaction. Figure 2 shows a timeline of a contract exposure. The figure shows the different stages of the purchase to pay cycle.

Figure 2 FX contract exposure



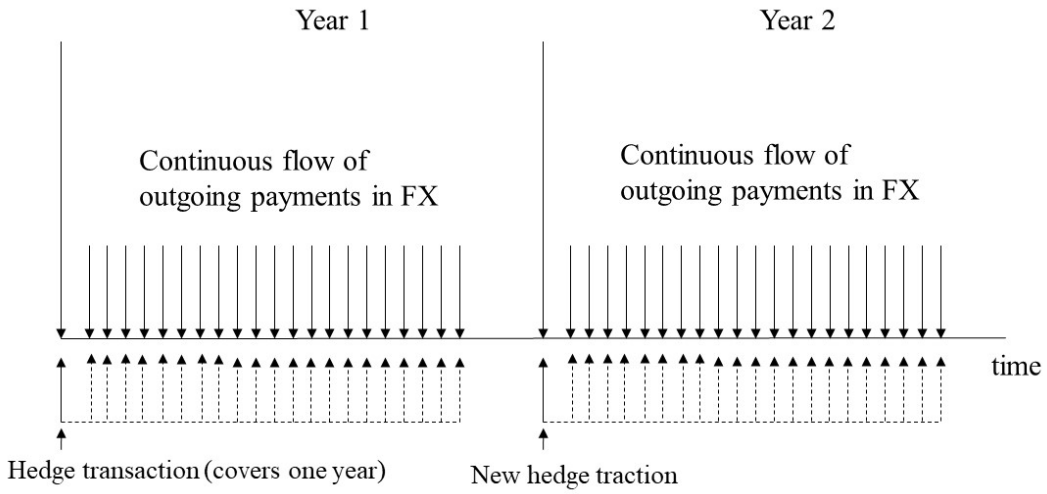
Between period 0, the moment on which the supplier has sent his proposal, and period 1, the moment on which the client accepts the order, it is not clear whether there will be an FX exposure. The exposure starts to exist at period 1, once the proposal is accepted, and will continue to exist until period 3, the moment at which the invoice will be paid.

Only when a proposal is accepted, it is certain that either the seller of the buyer will be facing an FX risk. And, in principal, only from that moment on he can decide to hedge the risk or leave the position open. In the time interval between period 0 and period 1 it is usually unwise to hedge the FX risk. If a company would decide to hedge the potential risk and if the proposal would not be accepted, then the hedge would turn into a speculative position. If a company choses to hedge a contract exposure, it will fit the settlement date of the hedge transaction to the agreed payment date.

3.2 Cash flow exposure

A cash flow exposure stems from a continuous and predictable flow of incoming or outgoing payments in a foreign currency. Examples are the frequent purchase of raw materials or fuel, of which the prices are mainly denominated is US dollars, or the export of magazines to a foreign country, the prices of which are always denominated in the local currency. In case of a cash flow exposure companies usually do not hedge every future cash flow separately but, instead, they execute one hedge transaction to cover all future cash flows in a specific future period simultaneously. Figure 3 show a company that executes only one hedge transaction (an FX forward) each year in order to hedge a continuous stream of incoming payments during the next year. The company can use FX swaps for proportional smaller amounts to fit the settlement date of the hedge transaction to the periods that the cash flows take place (FX swaps will be discussed later in this chapter).

Figure 3 Cash flow exposure



4 FX risk management policy

Companies that have international operations should have a policy regarding FX risk. This policy may be to avoid FX risk completely. Large companies can try to do this by using their bargaining power in order to agree with their business partners that all their incoming and outgoing invoices should be stated in the domestic currency of the large company. By doing this they pass the FX risk on to their business partners.

A second way to avoid FX risk is to match the incoming and outgoing payments in every single foreign currency. If a Dutch company, for instance, invoices in US dollars, then it can try to have its purchases also be denominated in US dollars. Another example is a German car company that decides to produce cars for the US market in the USA.

If a company succeeds in matching the volume of the incoming and outgoing payments in a particular currency, it is most probably still be faced with the problem that the incoming and outgoing payments will not exactly take place on the same settlement date. After all, usually companies first have to pay their suppliers before the will be paid by their customers. If this is the case in for cash flows in a foreign currency, for instance US dollars, it is non sensible for a Dutch company to first buy the US dollars which it needs to pay to the US supplier and later sell the US dollars which it receives from its customers. The company would then still run an FX risk. An better alternative is that the company opens a US dollar account at its banks and takes up a US dollar loan in order to pay its supplier. The company can pay back the loan once the customers will pay their invoices.

Most companies, however, are not able to match all incoming and outgoing payments in foreign currency. The difference between the incoming and outgoing payments in a foreign currency is called the net exposure. For small companies it is rather easy to determine their net exposure. For large companies with many subsidiaries, however, this is more difficult. To overcome this problem these companies sometimes set up a central treasury department that is acting as an in-house bank for all business units. Every business unit is required to report their expected FX cash flows to the central

treasury department which makes is possible for this department to assess the net exposure for the whole company. The central treasury department hedges only this net exposure. Offsetting incoming and outgoing payment is referred to as netting.

Once a company has determined its FX risk, it has to make a decision whether it will hedge the risk or not and, if yes, how it will hedge the risk. Some companies, typically US companies, choose to leave the FX position open. Other companies choose to hedge the FX risk completely (full cover) or partially (selective cover) by using FX forwards and FX options.

5 FX forward

An FX forward contract, in the Netherlands also known as an FX outright contract, is a contract in which two parties enter into a reciprocal obligation to exchange a certain amount of one currency on a future date for a predetermined amount in another currency.

Because settlement only takes place on a moment different from the spot date, the FX spot rate is adjusted. The level of the adjustment is based on the difference in the interest rates for the two currencies involved and is represented by swap points. One swap point for EUR/USD, for instance, is equal to 0.0001. Swap points are the translation of a difference in interest rates between two currencies into the difference between the FX spot rate and the FX forward rate.

Example

On 12 May 2019, the ING Bank euro-dollar trader transacts an FX forward with the Deutsche Bank euro-dollar trader in which he buys 10,000,000 euro for US dollars with delivery date 14 May 2020 (one year after the spot date). The EUR/USD cash rate is 1.1475 and the swap points amount to -130. The EUR/USD FX forward rate is thus 1.1345.

On 14 May 2020, ING Bank must transfer an amount of 11,345,000 US dollars to Deutsche Bank and Deutsche Bank must transfer an amount of 10,000,000 euro to ING Bank.

5.1 The application of FX forwards by companies

FX forwards are commonly used by companies that wants to fix the amount in the local currency of a future cash flow that is denominated in a foreign currency. These future cash flows are usually the result of export transactions or import transactions.

Example

A Dutch company has sold goods to a client in the UK. The invoice amount is stated in GBP and amounts to GBP 700,000. The agreed payment date is 8 July. In order to hedge the FX risk, the company has conducted the following FX Forward with its bank: Sell GBP 700,000 against EUR at a GBP/EUR rate of 0.9200. Figure 4 shows the cash flows that will take place on 8 July

Figure 4 Expected cash flows as a result of a sale contract en as a result of an FX Forward

Figure 4 shows that on a net basis, on 8 July, the company has only one incoming cash flow, i.e. EUR 760,869.57. If neither the client nor the bank will default, the company can be sure of the fact that this is the amount in EUR that it will receive as a result of

the export transaction. Changes in the EUR/GBP rate will have no impact on this anymore.

5.2 Offsetting FX forward contracts

Sometimes, an import or export transaction is cancelled. If a company has entered into an FX forward contract, then this FX forward contract will be superfluous. The company will then probably want to undo the FX forward. In fact, in all master agreements between banks and their clients, it is agreed that a client is required to undo the FX forward if the so called underlying position ceases to exist. This is also true if a position becomes smaller. The client is then required to undo part of its FX transaction.

Undoing an FX Forward can be done by concluding a reverse FX forward for the same amount and with the same value date. This is referred to as closing-out the FX forward contract. In contrast to exchange traded transactions, where offsetting automatically leads to the unwinding of the original contract, in case of over-the-counter transactions, such as FX transactions, the two opposing contracts will, in principle, continue to co-exist.

Example

A French company has signed an import contract with an American supplier for an amount of USD 2 million. The expected payment date is 10 October. The importer has conducted an FX forward contract with its bank in which it buys the US dollars against a EUR/USD forward rate of 1.1200. On 8 September, the importer hears that the supplier has gone bankrupt and that delivery will therefore not take place. The payment of USD 2 million on 10 October will therefore also not take place.

Since the importer has already purchased the US dollars from the bank, as a result of

the FX forward transaction he now has an undesirable long position in US dollars. To close this position, the importer must conduct a reverse FX forward contract in which he sells USD 2 million value 10 October.

Suppose that on 8 September the EUR/USD spot rate is 1.1385 and the one month premium is 0.0015. The one month FX forward rate is therefore 1.1400. With the settlement of the two FX forward contracts on 10 October, the following transfers are carried out in the bank accounts of the importer:

USD account: debit 2,000,000 and credit 2,000,000
Euro account: debit 1,785,714 (2,000,000 / 1.1200) and credit 1,754,386 (2,000,000 / 1.1400)

On balance, the two transactions result in the debiting of the euro account of the importer with an amount of EUR 31,328. This is a loss for the company.

5.3 The application of FX forwards to hedge the FX risk of investment portfolios

Asset managers, mutual funds and pension funds regularly use FX forwards in order to hedge the value of portfolios which are denominated in a foreign currency.

Example

A Dutch asset manager has a portfolio US shares with a current market value of USD 50 million. The current EUR/USD rate is 1.2500. The counter value in euro of the portfolio is, therefore, 50,000,000 / 1.2500 = EUR 40,000,000.

The asset manager has the vision that the US dollar will become weaker during the next three months, i.e. the EUR/USD rate will rise. If he is right then the counter

value in euro of the portfolio will go down. In order to hedge the position, the asset manager can conduct an FX Forward contract. This contract must compensate the effect on the value of the portfolio of the expected change in the exchange rate. This means that the FX Forward contract must give a positive result if EUR/USD goes up. This is why the asset manager sells USD 50,000,000 forward. We assume that the forward rate is equal to the spot rate, i.e. 1.2500.

We will now discuss to possible scenarios:

1. The USD dollar has become weaker; after three months the EUR/USD rate is 1.3000.

The counter value of the shares portfolio has decreased from EUR 40,000,000 to 50,000,000 / 1.3000 = EUR 38,461,538.46. This means a decrease in value of EUR 1,538,461.54.

After three months the FX forward contract expires which means that the asset manager is required to transfer 50,000,000 USD to the bank. In order to be able to fulfil the settlement requirement, the asset manager has to conduct an FX spot transaction in which it buys USD 50,000,000 at the spot rate of 1.3000. As a result of the FX forward contract, the asset manager receives 50,000,000 / 1.2500 = EUR 40,000,000 and as a result of the FX spot transaction the asset manager has to pay 50,000,000 / 1.3000 = EUR 38,461,538.46.

On balance the result of the hedge is EUR 40,000,000 – EUR 38,461,538.46 = EUR 1,538,416.54. This means that the hedge has completely compensated the loss in the share portfolio.

2. The USD dollar has become stronger; after three months the EUR/USD rate is 1.2000.

The counter value of the shares portfolio has increased from EUR 40,000,000 to 50,000,000 / 1.2000 = EUR 41,666,666.67. This means an increase in value of EUR 1,666,666.67.

After three months the FX forward contract expires which means that the asset manager is required to transfer 50,000,000 USD to the bank. In order to be able to fulfil the settlement requirement, the asset manager has to conduct an FX spot transaction in which it buys USD 50,000,000 at the spot rate of 1.2000. As a result of the FX forward contract, the asset manager receives 50,000,000 / 1.2500 = EUR 40,000,000 and as a result of the spot purchase of USD the asset manager has to pay 50,000,000 / 1.2000 = EUR 41,666,666.67.

On balance the result of the hedge is EUR 40,000,000 – EUR 41,666,666.67 = - EUR 1,666,666.67. This means that the loss of the hedge has completely erased the gain in the share portfolio.

The result of the FX forward is that the value of the shares portfolio has been fixed at EUR 40,000,000.

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6 Non-deliverable forward

For many currencies there is no liquid market which means that these currencies cannot be traded easily. Examples are the Chinese Yuan, the Brasilian real and the Philippine peso. A European company, for instance, cannot buy PHP in order to pay his Philippine supplier. The company can avoid this problem by asking the supplier to state the invoice in euro's instead of Philippine peso. This means that the FX risk now lies with the Philippine company. To avoid this risk, the parties often a so called currency clause.

This means that the invoice amount is not stated in a fixed amount of USD or EUR but in a fixed amount in the counter currency, however the invoice is still paid in USD or EUR for an amount that is the counter value of the amount in the counter currency on the maturity date of the contract (the fixing date).

Example

A Dutch company has signed an import contract for an amount of 20,000,000 Philippine peso) PHP but the invoice amount will be paid in EUR. This means that on the payment date an amount in EUR is paid, which is equivalent to PHP 20,000,000 calculated with the EUR/PHP FX rate on the payment date.

If the EUR/PHP FX rate on the payment date would, for instance, be 5.10, then the Dutch company would pay 20,000,000 / 5.10 = EUR 3,921,568.63.

If the EUR/PHP FX rate on the payment date would, for instance, be 4.90, then the Dutch company would pay 20,000,000 / 4.90 = EUR 4,081,632.65.

By agreeing a currency clause, the FX risk now lies with the Dutch importer. He can now hedge himself by concluding a non-deliverable forward (NDF). An NDF is an FX instrument in which the difference between the contract FX rate and the spot FX rate on the fixing date is settled. You could say that an NDF is an FX forward contract with cash settlement instead of physical delivery. In theory, the rate for an NDF is determined in the same way as the FX forward rate for a regular FX forward contract.

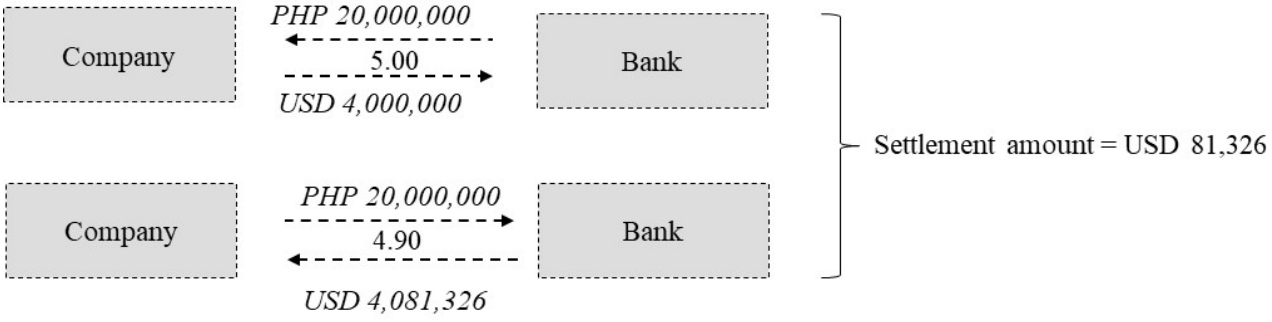
On the expiry date of an NDF contract the two currencies are not actually exchanged at the agreed contract rate. Instead, a cash settlement takes place in the convertible currency based on the difference between the contract rate and the FX spot rate on the maturity date of the NDF contract.

If a company receives an invoice for 20,000,000 PHP to be paid in the EUR against the current EUR/PHP rate after 3 months, then, as we already have seen, the risk is that the EUR will become weaker against the PHP and, as a result, that the company will have to pay more EUR to the Philippine exporter.

In order to hedge itself the company can sell an NDF EUR/PHP for a contract amount of 20 million PHP. Let us assume that the contract rate of the NDF is 5.00 and that the fixing rate after three months is 4.9.

The diagram below shows how the settlement amount of the NDF is calculated. The NDF is represented by a virtual FX forward at the contract rate of 5 and a virtual offsetting transaction at the spot rate on the fixing day of 4.9.

Figure 5 Calculation of the settlement amount of an NDF



The settlement amount of the NDF is (20M / 5.0000) -/- (20M / 4.9000) = 4,000,000 – 4,081,326 = 81,326. The EUR has become weaker and, therefore, the seller of the PHP is receiving the settlement amount from the buyer (i.e. the bank).

On the fixing date, the company also has to pay the invoice (the counter value of EUR 20,000,000), i.e. EUR 20,000,000 / 4.910 = EUR 4,081,326. Together with the cash settlement of the NDF, this leads to a total outgoing cash flow of EUR 4,000,000.

By concluding the NDF, the company has fixed its outgoing EUR cash flow at EUR 4,000,000. This would also be the case if there would have been a liquid market for PHP and the company could have conducted an FX Forward.

7 FX options

Options are instruments whereby one party has a unilateral obligation while, the other party has a unilateral right. The right in an option contract can relate to

- the purchase/delivery of a specific financial value at a pre-agree price;
- the settlement of a difference between an interest rate or price conducted in the contract and the actual interest rate or price at some future moment;
- entering into a transaction against a pre-agreed price or interest rate.

Option contracts with straight forward conditions are called plain vanilla options. In addition to plain vanilla options, there is also a wide range of so called exotic option.

The right under an option can be used as a hedge against adverse price movements without losing the opportunity to profit from favourable price movements. The right, however, can also be used to speculate on favourable price movements without being exposed to possible adverse price movements. Thus, the holder of the right can only win. However, to enjoy such a comfortable position, a price must be paid: the option premium.

The pre-agreed price or interest rate in an option contract is called the exercise price or strike price. The party who receives the right is the buyer of the option, the party providing the right is the seller. Selling options is also called writing.

A right to purchase a financial value or to receive a sum of money if the market price is higher than the strike price is called a call option. A right to sell a financial value or to receive a sum of money if the market price is lower than the strike price is called a put option. The maturity date of an option contract is called the expiry date. On this date the buyer of the option has to decide whether he makes use of his right or not.

Using the right is referred to as exercising the option.

FX options are expressed in a particular way. The reason for this is the fact that FX transactions comprise both a sale of one currency and a purchase of another currency. The right to buy one currency at a specific strike price, therefore, is equivalent to the right to sell another currency. This is why FX options are expressed by mentioning the two rights simultaneously. The right to buy EUR against USD is expressed as follows: EUR call / USD put. And, for instance, the right to sell GBP against US dollars is expressed as: GBP put / USD call.

7.1 The option premium

The market party who buys an FX option, receives a right that he can use to protect against unfavourable developments of exchanges rates, whereas at the same time, he still can profit from favourable developments. This brings him in a position where he can only win. However, in order to reach this position the buyer of the option has to pay a price, i.e. the option premium.

The option premium is usually paid at the start of the contract period. The premium for over-the-counter options can be expressed in different ways:

- as a number of points of a price
- as a percentage of the underlying value
- as an amount to be paid in one of the currencies.

Example

A client wants to buy an over the counter GBP call / USD put option. The premium is expressed in points: 500 points (= USD 0.0500). The size of the option contract is EUR 2,000,000. The premium for this option is USD 2,000,000 x 0.0500 = USD 100,000.

Just like the price of most other financial instruments that are traded on the financial

markets, the price of an option is determined by supply and demand. The price is, amongst others, dependent on the difference between the current FX rate of the underlying currency pair and the strike price and also on the volatility of the FX rate.

7.2 Application of FX options

As an example we take a US company that has to pay an amount denominated in GBP to its UK supplier in three months. The risk of the company is that during the coming period of three months the GBP will become more expensive. The company could hedge itself by transacting an FX forward contract in which it would buy the GBP forward. However, this would mean that the company could not profit if the GBP would become weaker. Put in other words, with an FX forward transaction the company would accept the risk of opportunity loss. If the company does not want to accept this risk, and still wants to hedge against unfavourable changes of the GBP rate, it should buy an option. In this case the appropriate option would be a GBP call / USD put. (If the company would have a strong vision that the GBP would rise, it could better choose for an FX forward because the chance to incur opportunity loss is then very small and the option premium would only be a waste of money).

Let as assume that the current GBP/USD spot rate is 1.3300 and that the US company buys a GBP call / USD put option with a strike price of 1.3500 for a contract amount of GBP 500,000. This means that on the expiry date of the option the company has the right to buy 500,000 GBP at a rate of 1.3500 US dollars.

The table below shows the result of the option under two different scenarios:

GBP/USD rate on the expiry date	**Exercise or not**	**FX transaction**
1.3000	no	The company buys the GBP 'in the market' at the spot rate of 1.3000
1.3800	yes	The company buys the GBP from the seller of the option at the strike price of 1.3800

The table shows that, if at the expiry date the FX rate would be 1.3000, then the company would not use its right to buy the GBP. The option is now said to expire worthless and to be 'out-of-the-money'. Out-of-the-money (otm) means for a call that the spot rate is lower than the strike price and for a put that the spot rate is higher than the strike price.

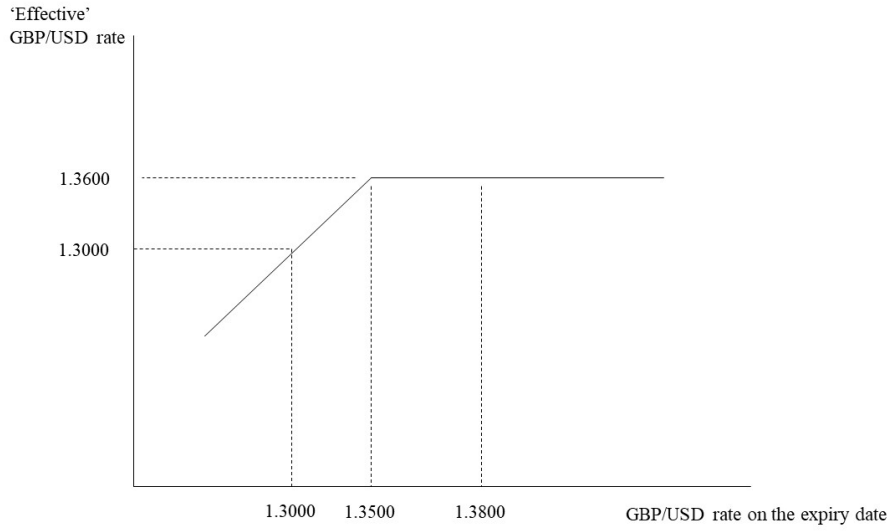
The table shows that if, on the other hand, at the expiry date the FX rate would be 1.3800, then the company would use its right to buy the GBP at 1.3500. The option is now said to be exercised and to be 'in-the-money'. In-the-money (itm) means for a call that the spot rate is higher than the strike price and for a put that the spot rate is lower than the strike price

If we take the option premium into account, we can calculate the effective rate that the company realizes. The effective rate is the rate including all incurred costs. Let us assume that the company has paid a premium of 0.0100 for the option. The table below shows the effective rates under different scenarios.

GBP/USD rate on the expiry date	Purchase rate	Paid premium	Effective rate
1.3200	1.3200	0.0100	1.3300
01.3400	1.3400	0.0100	1.3500
1.3500	1.3500	0.0100	1.3600
1.3800	1.3500	0.0100	1.3600
1.4000	1.3500	0.0100	1.3600

The table shows that the maximum rate for the company is 1.3600. For every spot rate lower than the strike price of 1.3500 the company can profit. However because of the paid premium of 0.0100, effectively, it is always paying 0.0100 more than it would have paid if it would not have bought the FX option. Figure 6 shows a diagram of the effective rates under different scenarios for the FX rate at the expiry date of the option.

Figure 6 Effective rates as a result of the purchase of a GBP call /USD put with a strike price of 1.3500



The table below shows the result of three different actions that the company can undertake to handle its FX risk with different FX rates at the expiry date of the option. The three alternatives are:

1. Leave the position open and conduct an FX spot transaction after three months
2. Conduct an FX forward at a rate of 1.3300
3. Buy a GBP call / USD put with a strike price of 1.3500

GBP/USD rate on the expiry date	Alternative 1 No hedge	Alternative 2 FX Forward	Alternative 3 buy GBP call / USD put
1.3000	1.3000	1.3300	1.3100
1.3200	1.3200	1.3300	1.3300
1.3300	1.3300	1.3300	1.3400
1.3400	1.3400	1.3300	1.3500
1.3500	1.3500	1.3300	1.3600
1.3800	1.3800	1.3300	1.3600
1.4000	1.4000	1.3300	1.3600

The table shows that for every FX rate at the expiry date lower than 1.3300 alternative 1 (no hedge) gives the best result whereas for every rate higher than 1.3300 the FX Forward gives the best result. The conclusion is that the FX option would never give the best result. The table below summarizes the pros and cons of an FX option compared to leaving the position open and compared to the FX Forward.

	Advantage of the FX option	**Disadvantage of the FX option**
Leave the position open	Company is protected against higher rates (break-even rate = 1.3600)	Company has to pay a premium
FX Forward	Company can profit from lower FX rates (lower than 1.3200) i.e. no opportunity loss	Company has to pay a premium

In the above example the reason for the company to buy an FX option was to hedge itself against unfavourable changes in FX rates but at the same time keep the potential to profit from favourable changes in FX rates.

Another reason for a company to buy an option could be if the company has proposed for an export order denominated in a foreign currency which is not already accepted. During the period between the moment that the proposal is sent and the moment on which the company will know whether the proposal is accepted or not, the company has a potential FX risk. If the company already wants to hedge this risk it makes no sense to buy an FX forward in which it sells the foreign currency because an FX Forward gives the company an obligation to sell the foreign currency. If the order would not be accepted, the company would be left with an open position and would have to buy the foreign currency at the then prevailing spot rate. Instead of hedging this would mean that the company is speculating. In this case an FX put option on the foreign currency would be a better alternative because the option would give the

company only the right to sell the foreign currency and not the obligation.

8 Cylinder Option

When market parties develop a hedging strategy using options, they often consider a combination of different options. An important reason for this is that parties who want to hedge are often reluctant to pay the option premium. With this in mind, banks have developed a number of strategies whereby the protection which is provided by options remains intact but whereby the company or investor does not need to pay a premium. Option strategies whereby the client does not have to pay a premium are referred to as zero cost option strategies. An example of a zero-cost strategy is a cylinder option or risk reversal.

A cylinder option is a combination of a purchased otm call option and a sold otm put option or vice versa. The two options in a cylinder have different strike prices, i.e. one that is higher that the FX forward rate at the moment of concluding the deal and one that is lower than that rate.

A market party who wants to hedge against a rise in a foreign currency can conclude a risk reversal whereby he buys the call option on the foreign currency and, instead of paying premium, sells a put option on this foreign currency. In order to make this strategy zero-cost, both options should be equally out-of-the-money.

Example

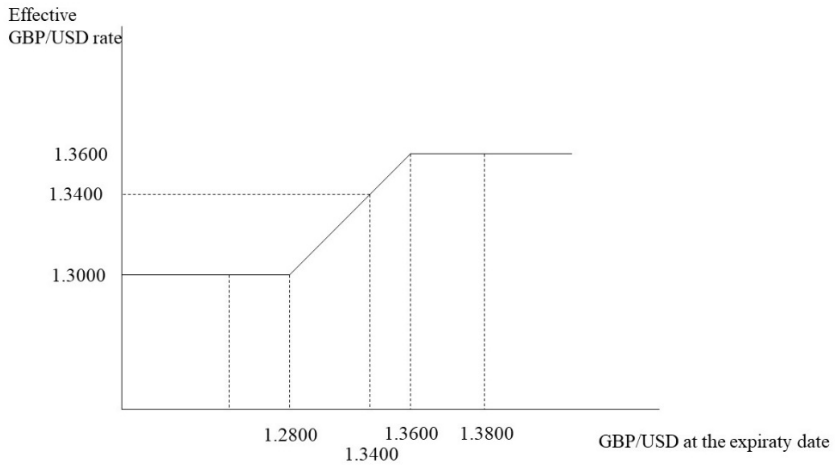
An American importer wants to hedge himself against a rise of the GBP/USD rate. The current GBP/USD FX forward rate is 1.3300. He chooses to use a risk reversal in which he buys a GBP call / USD put option with a strike price of GBP/USD 1.3600 (out-of-the-money). The size of the option contract is GBP 10 million and the premium is USD 300,000. The importer also sells a GBP put / USD call option with a strike price of 1.3000. This option is just as much out-of-the-money as the purchased GBP call/USD put option and, for a contract size of GBP 10 million, its premium is also USD 300,000.

At the expiry date, the importer will exercise his GBP call / USD put option for each rate above 1.3600 and thus buys GBP 10 million at 1.3600. For each rate lower than 1.3000, the bank will exercise its GBP put / USD call option and sells GBP 10 million to the company at 1.3000. For all rates between 1.3000 and 1.3600, neither of the options will be exercised and the importer can buy the GBP in the market at the market rate. This is shown in the following table.

GBP/USD FX rate on expiry date	**FX transaction on expiry date**	**Effective rate**
1.3800	Importer exercises GBP call option and buys GBP 10,000,000 against the strike price (1.3600)	1.3600
1.32400	Importer buys GBP 10,000,000 in the market against 1.3400	1.3400
1.2800	Bank exercises GBP put option. Importer has to buy GBP 10,000,00 against the strike price (1.3000)	1.3000

Figure 7 shows a diagram of the above described risk reversal.

Figure 7 Cylinder option or risk reversal



A risk reversal can also be conducted by a party that wants to protect itself against a decrease in the FX rate of a foreign currency. This party would buy an out-of-the-money put option on this foreign currency and simultaneously sell an out-of-the-money call option on this currency.

9 FX swap

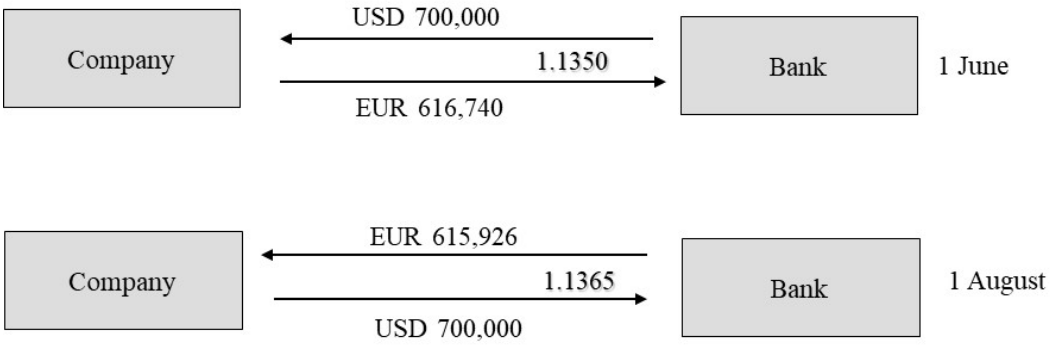
An FX swap is an OTC currency derivative contract with a short term, in which two parties enter into a reciprocal obligation to exchange a certain amount of two currencies on the spot date at the FX spot rate and to reverse this exchange in the future at the FX forward rate. The exchange at the beginning of the maturity period is called the near leg (spot leg or first leg), the exchange at the end of the maturity period is called the far leg (forward leg or second leg).

Example

A company buys 700,000 US dollars per spot to a bank against 616,740 euros (spot rate 1.1350). At the same time the company agrees to sell back the 700,000 US dollars on 1 August against 615,926 euros (forward rate 1.1365).

Figure 8 shows the diagram of the FX swap transaction which is discussed in the above example.

Figure 8 FX Swap



Although an FX swap is a combination of two FX transactions which are traded at the same moment, in fact it is not really a currency instrument. The reason for this is that real FX instruments involve a permanent exchange of two currencies. A Dutch company that, for instance, has a long position on its US dollar current account and sells these US dollars via an FX spot transaction, loses these US dollars permanently. And a company that, for instance, buys British pounds through an FX Forward transaction, has, as a result of this transaction, the permanent disposal over the pounds.

In both examples the currency position of the company changes permanently (if nothing else happens).

An FX swap, on the other hand, only results in a temporary exchange of currencies. The transaction that is shown in figure 8 shows that on 1 June the company had a shortage in US dollars which it covers temporarily by the FX swap. It transfers the same amount of US dollars back on 1 August which means that the currency exposure of the company did not change as a result if the FX swap. On the other hand, at the start date of the FX swap the company had a surplus in euro which it will regain at the maturity date.

This means that an FX swap is not an FX instrument but instead a liquidity instrument. The FX swap is, in fact, a combination of two opposite loans in two different currencies for the same initial value. The company that has executed the transaction that is shown in figure 8, for instance, has borrowed 700,000 US dollars from the bank from 1 June to 1 August whereas it, at the same time, it has invested in a EUR deposit of EUR 616,740 during the same period.

If a market party grants a loan to another market party, it will charge interest. The company in the example will thus be charged interest on the USD loan, but, on the other hand, it will receive euro interest over the euro deposit. The two interest amounts are taken together and the difference between these amounts is reflected in difference between the exchange rates of the near leg and the far leg.

Figure 8 shows that the FX rate in the first leg of the FX swap is 1.1350 and that the FX rate in the second leg is 1.1365. The reason for this difference lies in the fact that the euro interest rate is lower than the US interest rate. This means that the company has to pay more interest on the US loan than it receives for the euro investment. The difference between the interest rate in the euro area and in the USA is in this case unfavourable for the company. If the company would have conducted the FX swap the other way around (i.e. first sell the USD and later buy them back), then the company

would have invested the USD at the higher interest rate and would borrowed the euro at the lower interest rate. In this case the interest differential would be favourable for the company.

9.1 Rolling over FX forward contracts using FX swaps

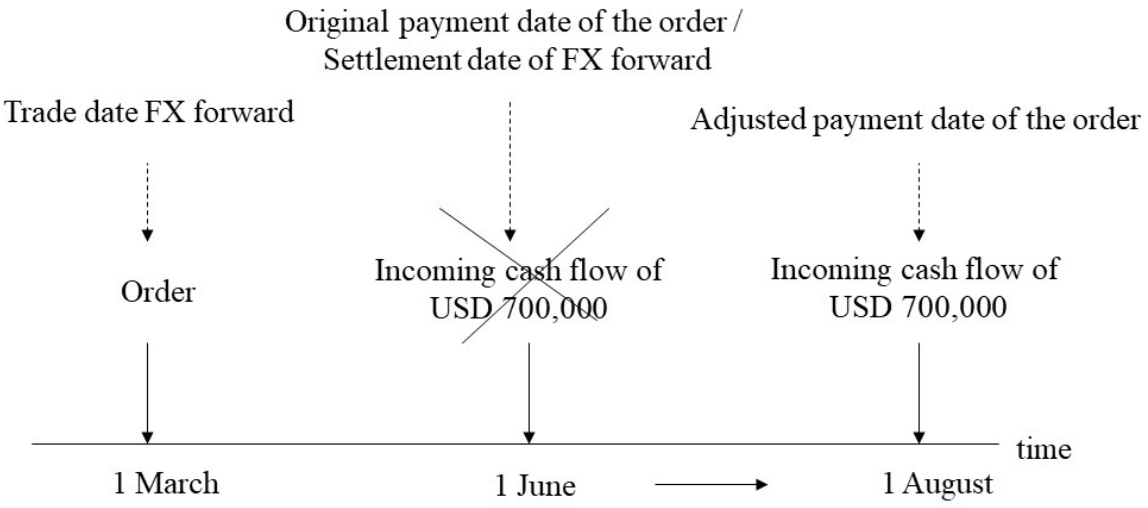
Companies often use FX swaps to change the value date of an FX forward transaction. This is referred to as rolling over an FX forward transaction. Rolling over an FX forward is necessary if an anticipated cash flow, that is hedged through an FX forward, appears to take place at another moment than expected.

Example

On 1 March a company has received a confirmation that its US client has accepted an order of USD 700,000. The agreed payment date is 1 June. In order the hedge the FX exposure, the company immediately concludes an FX forward, in which it sells 700,000 US dollar with settlement date 1 June.

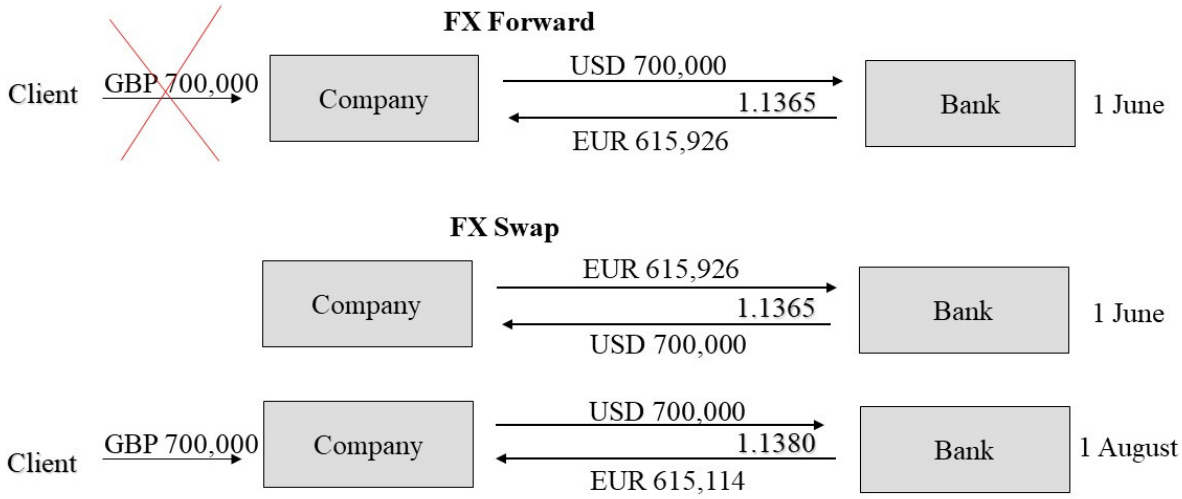
At the end of May the client notifies the company that it is not able to pay and that he expects that he will only be able to pay on 1 August. This situation is shown in figure 9.

Figure 9 Postponement of an expected cash flow in a foreign currency



The company would now prefer to settle the FX forward on 1 August instead of 1 June. To achieve this, it can conduct an FX swap in which the first leg falls on 1 June and the second leg on 1 August. In the first leg, the company buys USD 700,000 million against euro and, as a result, on 1 June the transfers on its US dollar account will cancel each other out. On 1 August, in the second leg of the FX swap, the company sells the USD 700,00 that it will receive as a result of the late payment. This is shown in figure 10.

Figure 10 Rolling over an FX forward contract in case of a delay in payment by a foreign client

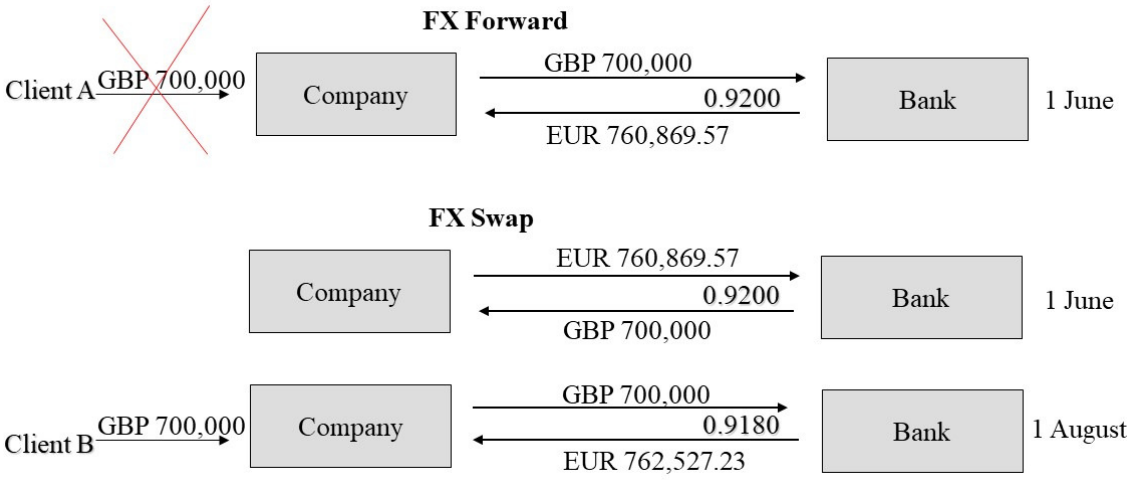


The upper right-hand side of figure 10 shows that the expected incoming client payment of USD 700,000 will not go through. The right-hand upper side of the diagram shows, however, that as a result of the FX forward transaction the company is required to sell 700,000 USD to the bank. If the company would take no other action, then its US dollar current account would become to show a deficit of USD 700,000 which would be charged by the bank with a high interest rate. This deficit would last until the client will eventually pay. This is expected to be on 1 August. To avoid the temporary deficit on its US dollar current account, the company transacts an FX swap in which it buys USD 700,000 in the first leg (settlement 1 June) and sells the USD back on the moment that the client is expected to pay (1 August). The two legs of FX swap are shown in the lower side of the diagram.

If we look at the cash flows on 1 June, it becomes clear that the USD cash flow resulting from the original FX forward is cancelled out by the USD cash flow in the first leg of the swap. And if we look at the cash flows on 1 August, we see that the company can use the 700,000 US dollars that it receives from its client to fulfil the USD payment obligation in the second leg of the FX swap.

FX swaps can also be used if an expected transaction will not go through. In paragraph 5.2 we discussed a situation in which an export transaction was cancelled. The company had conducted an FX forward transaction in which it sold the expected GBP proceeds of GBP 700,000. If the company would expect another export transaction to the UK in the future, then, instead of offsetting the FX forward it can conduct an FX swap in which it buys GBP 700,000 from the bank in the first leg and sells 700,000 GBP in the second leg. The settlement leg is now set at the date that a future export transaction to the UK will take place. This is shown in figure 11.

Figure 11 Rolling over an FX forward in case of default and expected other export transaction

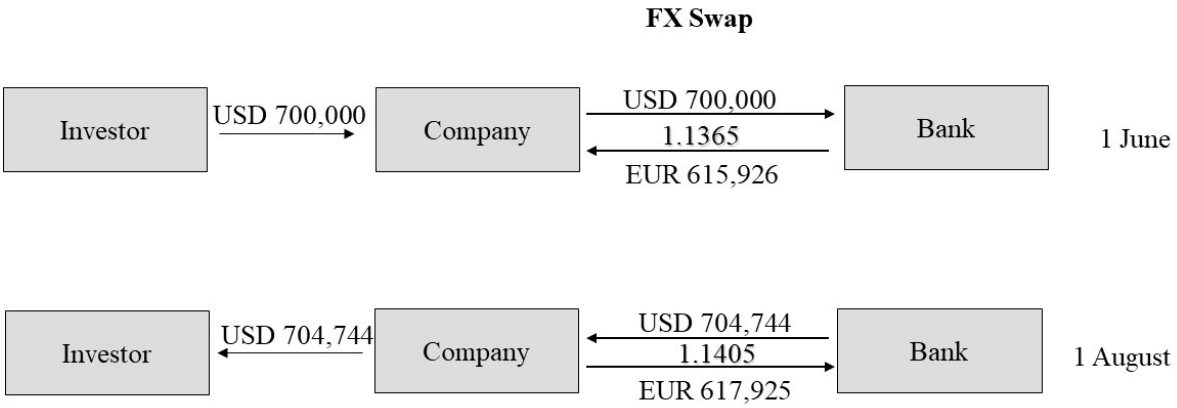


9.2 Synthetic short-term euro funding

If an organization has a funding requirement in its domestic currency, it can consider to conduct a synthetic loan to lower its interest costs. For short terms a synthetic loan can be realized by concluding a money market loan in another currency than the domestic currency and by using an FX swap to convert the proceeds from this FX loan temporarily to the domestic currency. In theory, this should not help the organization much; the interest rate differential between the loans in the two currencies is, after all,

included in the FX forward rate used in the far leg of the FX swap. However, in practice, the implied interest differential in the FX swap points often differs slightly from the FX swap points that should theoretically apply based on the differences between the money market interest rates in the relevant currencies. This is because the money market and the market for FX swaps are two complete separate markets. As a result, arbitrage opportunities may arise. Figure 12 shows an example of a synthetic euro funding.

Figure 12 Synthetic short-term euro funding



The left-hand upper side of the diagram shows that the company has borrowed US dollars from an investor. The right-hand upper side of the diagram shows the first leg of the FX swap in which the company coverts the USD into euro. During the term of the USD loan / FX swap (i.e. from 1 June to 1 August) the company can dispose of the euro amount of EUR 615,926. On 1 August, the company has to pay back the borrowed USD amount to the investor plus the interest amount over the principal amount. This is shown in the left-hand bottom side of the diagram. At the same time, the company is buying the needed USD amount from the bank in the second leg of the FX swap. This is shown in the right-hand bottom side of the diagram.

Let us assume that the company can borrow euro from Dutch investors at 2% and that it can borrow US dollars from US investors at 4%. At first sight, under these conditions, it does not seem to make sense to borrow US dollars instead of euro. However, the interest differential is reflected in the swap points, i.e. in the difference between the FX rate in the first leg of the swap and the FX rate in the second leg of the FX swap. In the FX swap, the company is lending US dollars (theoretically at a rate or 4.00%) and is borrowing euro (theoretically at a rate of 2%). This means that the company is earning the interest differential of 2% in the swap, which means that the effective interest costs of the company are 4% (interest paid to the investors) - 2% (interest differential earned in the FX swap) = 2%.

Without proof we state that the theoretical swap points, under the above mentioned market conditions on the US and euro money market, can be calculated at 0.0038. However, in practice, the swap points do not exactly represent the interest rate differential between the rates that prevail in the different money markets. In our example which is shown in figure 12, the two- month swap points are 0.0040 instead of 0.0038. This means that the interest differential between EUR and USD in the swap is larger than in the money markets. Again without proof we state that the 40 swap points represent an interest rate differential of 2.09%. This means that the effective interest rate for the company is not 2.00% but only 1.91%, i.e. 4% (interest paid to the investors) – 2.09% (interest differential earned in the FX swap) = 1.91%.

At present. many companies make use of the market imperfections in the FX swap market.

10 Cross currency swap

A cross currency swap is an over-the-counter traded derivative in which two interest flows are exchanged in two different currencies. In these types of swaps at the beginning and at the end of the term, also principals in these currencies are exchanged, both at the same exchange rate (the FX spot rate).

A cross currency swap is in fact the same concept as an FX swap. This is because in both cases, there is an exchange of principals in the two currencies at the beginning, which is reversed at the maturity date. The main difference is that, with a cross currency swap, the interest coupons are paid out explicitly during the contract term whereas with an FX swap the interest rate differential is expressed as swap points and with an FX swap the FX rate for the final exchange is the FX forward rate and not the FX spot rate.

The choice for an FX swap or for a cross currency swap only depends on the desired contract term. FX swaps are commonly used for terms shorter than one year and cross currency swap are commonly used for terms longer than one year. Figure 13 shows a diagram in which a company has borrowed 10 million euro from the bank and, at the same time has invested 13,500,000 US dollars in the bank.

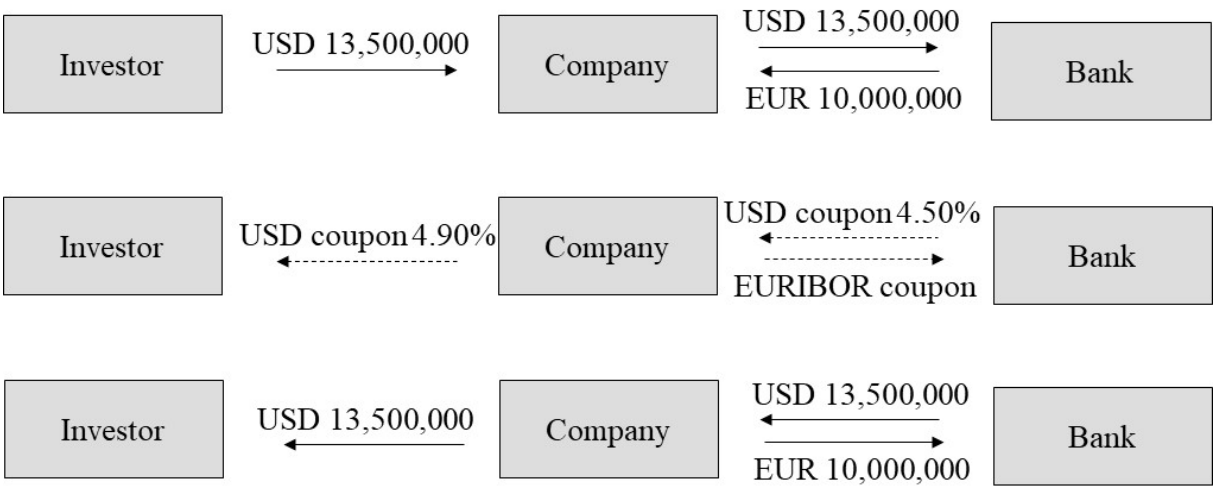
Figure 13 Cross currency swap

The diagram shows a cross currency swap with nominals of EUR 10,000,000 million and USD 13,500,000 million respectively. The principals are exchanged on the start date and are reversely exchanged at the maturity date. During the contract term the company, which has received the EUR principal on the start date, pays a coupon based on EURIBOR whereas the bank, which has received the USD principal on the start date, pays a fixed USD coupon of 4.90%. On the maturity date, both principals are paid

back.

Companies can use cross currency swaps to create synthetic loans for periods longer than one year in order to decrease their interest costs. Figure 14 shows a company that has issued a USD bond with a principal amount of USD 13,500,000. The company pays an interest rate of 4.90% to the investors. In the initial exchange of principals in the cross currency swap, the company converts the issue proceeds in USD to euro. During the term of the cross currency swap, the company is converting the USD coupon that it has to pay to the investors into a EURIBOR coupon. And, finally, at the maturity date of the bond, the company converts the 10,000,000 EUR that it has received as a result of the cross currency swap back to USD in order to be able to pay the investors back.

Figure 14 Combination of a USD bond and a cross currency swap; long-term synthetic euro funding



During the term of the structure, the effective interest costs for the company are: 4.90% + EURIBOR – 4.50% = EURIBOR + 0.40%.

If, for instance, the company would have had to pay EURIBOR + 0.45% for a straight

euro bond then the structure would be rewarding. The company can then profit from the fact that the difference between the rates for interest rate swaps in the two currencies is not the same as the difference between the rates in the bond markets in the relevant currencies. Such differences can arise when foreign investors have a specific interest in certain issuing institutions and see no investment possibilities within their own currency area. They are then looking for foreign issuers and have to settle for relatively low returns in their own currency.