Chapter 28: Trading in the Foreign Exchange Markets

Reading this chapter you will be introduced to the following key concepts:

- Foreign exchange markets
- Derivates in the foreign exchange markets
- Trading strategies in the foreign exchange markets

Introduction

The foreign exchange market, also known as the forex, FX, or currency market, is a worldwide decentralized over-the-counter financial market for the trading of currencies. The foreign exchange market determines the relative values of different currencies. It is said that "Money never sleeps": Trading can be made on foreign exchange markets 24h a day with the exception of weekends. It starts in Tokyo and Asia (Hong Kong and Singapore), shifts to the Middle East (Bahrain), goes on to Europe (London, Zurich and Paris), and eventually finishes in the Americas (New York, Chicago and San Francisco). The United Kingdom and the United States are leading the foreign exchange activities but Asia has become an important trading place.

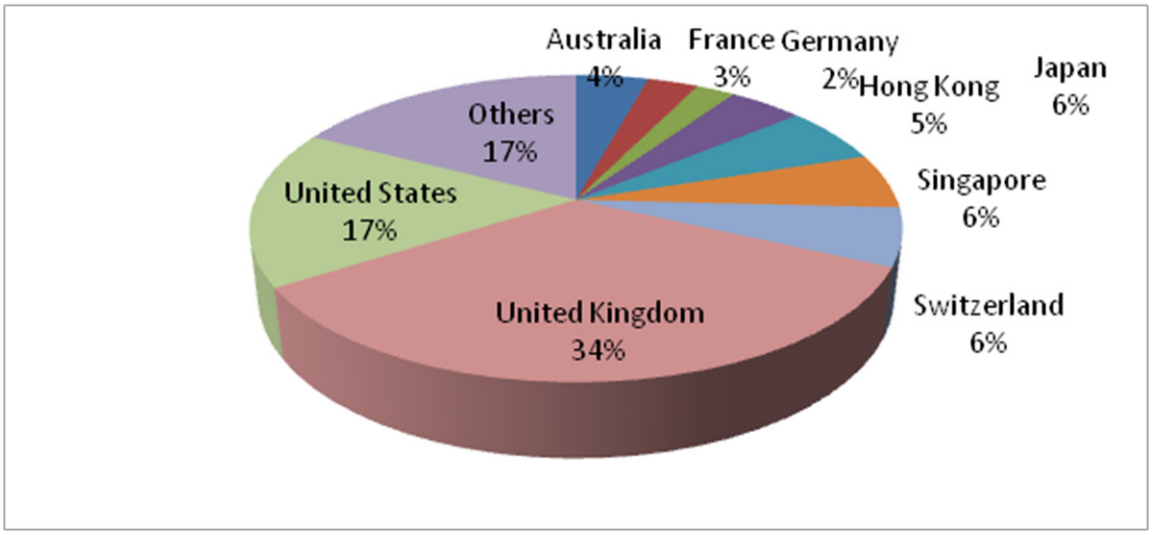


Figure 1: Geographical distribution of foreign exchange turnover in 2007. Source: http://www.bis.org/publ/rpfxf07t.pdf - page 13.

The foreign exchange market is by far the largest and most liquid market in the world. According to the Bank of International Settlement, or BIS, the average daily turnover was about USD3.2 trillion in 2007 and is still increasing over the years. In 2010 this had grown by approximately 20% to an average daily turnover of USD3.98 trillion. These flows can be seen as a result of the

continued effect of globalization as well as an indication of the growing importance of foreign exchange as an asset class.

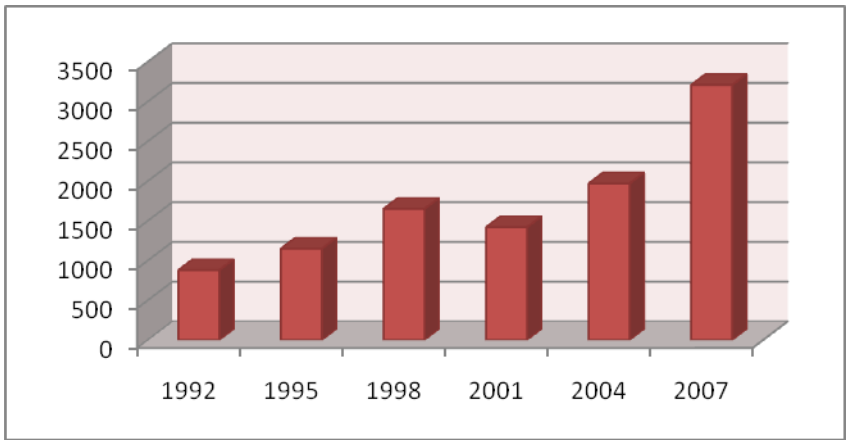


Figure 2: Global foreign exchange market turnover. Source http://www.bis.org/publ/rpfxf07t.pdf - page 10.

According to the BIS the USD 3.98 trillion of daily turnover can be broken down as follows:

- USD 1.490 trillion in spot transactions
- USD 475 billion in outright forwards
- USD 1.765 trillion in foreign exchange swaps
- USD 43 billion currency swaps
- USD 207 billion in options and other products

There are 170 pairs of currencies traded. Among all those, US dollar/Euro is the most common. "Majors" include the US Dollar (USD), the Euro (EUR), the Japanese Yen (JPY), the Sterling Pound (GBP), the Swiss Franc (CHF), the Canadian Dollar (CAD) and the Australian Dollar (AUD). "Minors" or "Exotics" represent all other existing pairs in forex.

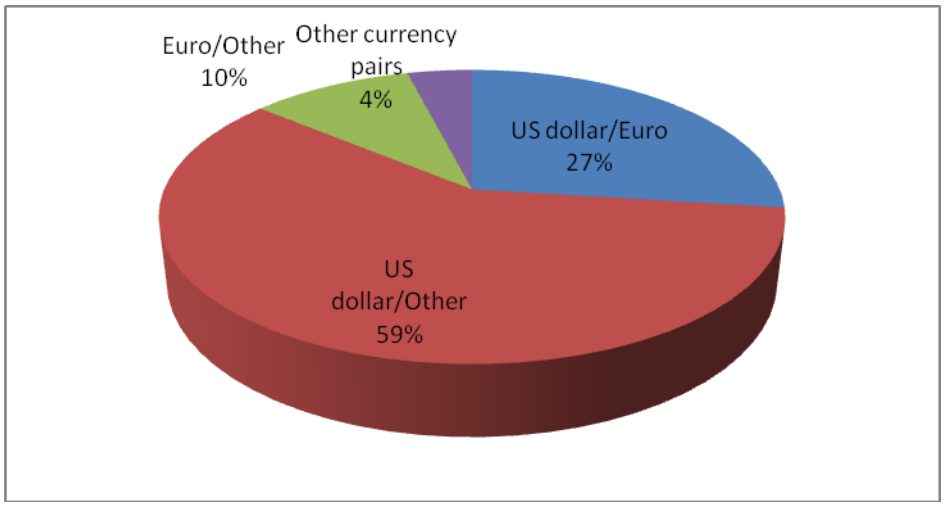


Figure 3: Reported foreign exchange market turnover by currency pair in 2007. Source http://www.bis.org/publ/rpfxf07t.pdf - page 16.

The foreign exchange market serves several purposes. First of all is serves to transfer purchasing power since international trade is made in different countries. The main instruments are interbank transfers and bills of exchange. The recipient of a bill of exchange is directed to pay a fixed amount to a third party at a future date. Besides this, the foreign exchange market is also an excellent source of credit for international traders. Examples of this are banker's acceptances and letters of credit. Moreover, by having access to international capital markets in investors and companies may be able to obtain financing at better terms. Finally, foreign exchange may also prove to be an interesting asset class for investing by itself.

In this chapter we first give a brief review of the foreign exchange market, the participants, and how prices are quoted. We then discuss the existing derivatives in this market and we explain how these products are used by traders and investors. Finally, we briefly review other ways to obtain exposure to foreign exchange markets.

Foreign exchange markets

Foreign exchange market as we know them today began forming in the 1970s when countries gradually switched to floating exchange rates from the previous exchange rate regime, which remained fixed as per the Bretton Woods system. In this section we briefly review these developments. We also discuss the fundamental determinants of exchange rates in a floating rate system as the one in place today.

From Bretton Woods to Floating Rates

The Bretton Woods conference in 1944 was the starting point of a new International Monetary System, or IMS, in the post-WW2 era. The USA at this time played a major role in the world economy, so the US dollar was chosen as the key currency. Gold was at the center of the system and the US dollar was directly convertible at $ 35 per oz. For this reason this particular IMS was called the Gold Exchange Standard.

In turn, each other country defined a fixed parity expressed either in gold or in US dollar. As the monetary authorities in each country adopted a par value, they committed to support their currency rate by trading on the foreign exchange markets as soon as the value was drifting by 1% up or down compared to its par value. The International Monetary Fund, or IMF, was created at the same time to supervise the exchange rate rules and to help countries manage their balance of payments.

In the late 1950's, the trade surplus of the United States began to collapse. The drawback of the Bretton Woods System was to incite the USA to clear their deficit with their own currency. As a lack of confidence in the US dollar increased in the early 1970's and reserves of gold in the USA dangerously decreased over this period. As a result of this, President Nixon announced in 1971 the end of the dollar convertibility in gold. This in turn was essentially the end of the fixed rate system.

The current system is instead characterized by floating rates; currency rates are adjusting according to offer and demand in the foreign exchange markets. Free capital movements since the 1980's have increased the volume of trading and the need for new financial products – the derivatives. The US dollar is still playing a major role because of its use as a reserve currency and a transfer currency.

Fixed Rates vs. Floating Rates

A currency rate is said to be fixed if the currency is pegged to another currency, generally the US Dollar or the Euro. Nowadays, several Arab countries and other states from the Caribbean and South America (Panama, Ecuador) have chosen a par value to the US Dollar. In the same manner, several European countries have chosen to peg their currency to the Euro. The decision to peg a currency is essentially political and keeping currencies pegged at values which are essentially undervalued can bolster trades from emerging countries. For example, since July 2008, China has decided to re-peg the Renminbi to US Dollar and the Chinese Central Banks keeps the currency in narrow bands. This has been an extremely criticized option because it aimed to help Chinese exporters and as a result of this China is running a large surplus on its trade balance. The Table below summarizes the main advantages and disadvantages of the fixed rate and floating rate systems, respectively.

Rates Regime	Advantages	Drawbacks
Fixed Rates	. No risk on exchange rate (no uncertainty) . Lower transaction costs . Anti-inflation system	. Central Banks have to maintain high reserves to be able to keep rates on a peg . May not reflect fundamentals of the economy
Floating Rates	. Decreasing of currency reserves for central banks . Autonomy of national economic policies	.External shocks may appear (cf. The Argentine Peso crisis)

The European exchange rate mechanism

In 1979 the European exchange rate mechanism, or ERM, was introduced along with the European currency unit, the ECU. Under this system each currency was de facto pegged against a basket of the European currencies. Two bands existed with ±2.25% or ±6% and periodic re-alignment of a given currency was allowed. The ERM was the first step towards a single European currency, the EURO, which was finally adopted by 11 of the European Union, or EU, countries in 1999. By January of 2002 EURO coins and banknotes were put into circulation. One of the cornerstones in this is the European Economic and Monetary Union, or EMU, of 1989 which involved not only fixed exchange rates but also a European system of Central Banks.

Clearly, one of the main arguments for this development was to facilitate trade in the European region. However, in spite of this several countries opted out of the EURO arguing that this would result in a loss of monetary independence. Another argument, which has been raised recently, is

that the European countries are too different to warrant a common currency. For example, the recent problems in Greece have been indirectly blamed on the tight fiscal and monetary policies imposed on this country by the regulation within the EURO-zone. In fact, it has been argued that this could well be the end of the EMU.

Fundamental determinants of exchange rates

In a floating rate system, the price of a currency, or in this case the exchange rate, is essentially determined by the supply of a given currency and the demand for this currency. While short run changes in demand and supply can be caused by e.g. speculators in the long run the price should be determined by the fundamentals of a country's economy.

Exchange rates in the long run

Amongst economists the most popular theory to explain exchange rates is the purchasing power parity, or PPP. The PPP basically says that, everything else equal, identical goods should have the same real price in different countries. For example, if a basket of goods costs GBP10 in the UK and USD20 in the US then the exchange rate should be 2USD/GBP. If it does not, say for instance that it is 1USD/GBP, Americans should buy the goods in the UK at half price. As they continue to do this the demand for GBP to pay with increases which in terms drives up the price of pounds. The PPP simply states that at any given time the following should hold:

Local price = Exchange rate * Foreign price.

While the PPP is static concept it should hold over time and hence the immediate prediction of it is that if prices remain constant so does exchange rates. However, good's prices do change as a result of e.g. inflation. And if prices increase to the double in the US with the exchange rate remaining at 2USD/GBP then Americans would again start to buy goods in the UK which would put pressure on the USD. The new "equilibrium" is reached when the exchange rate has reached 4USD/GBP. Note that the doubling of the price locally has lead to a doubling of the price of the foreign currency, the GBP. Mathematically we get the following relationship:

$$I_{DC}^{t} - I_{FC}^{t} = \frac{S_{DC/FC}^{t+1} - S_{DC/FC}^{t}}{S_{DC/FC}^{t}},$$

where $S_{DC/FC}$ is the spot exchange rate between domestic, DC, and foreign, FC, currencies and I_{DC} and I_{FC} is the expected inflation rate in the domestic and foreign country, respectively.

On obvious question that arises from the above is the following: if inflation is consistently higher in e.g. the US why would people hold that currency? The answer to this question is as simple as it is fundamental: because of interest rates. In particular, as investors continues to search for the highest return on their investments the real return of these should be equal across countries. If we assume that the real return is equal to the nominal return minus the inflation we have that

$$R_{DC}^{t} - R_{FC}^{t} = I_{DC}^{t} - I_{FC}^{t},$$

where R_{DC} and R_{FC} are the nominal interest rates in the domestic and foreign country, respectively. Substituting this into the above equation we obtain:

$$R^t_{DC} - R^t_{FC} = \frac{S^{t+1}_{DC/FC} - S^t_{DC/FC}}{S^t_{DC/FC}}.$$

That is, differences in nominal interest rates should be approximately equal to the changes in the exchange rate. This relationship is known as the International Fisher Effect.

Foreign exchange markets in the short run and the scope for technical analysis

The PPP provides theoretical predictions about the long run relationship between exchange rates and the above equations also created a link between changes in the exchange rates and interest rates differences between countries. One of the implications of this is that there should be no "real" reason for why holding USD in the long run should be a better investment than holding CAD. Thus, a somewhat "depressing" conclusion is that "fundamental" analysis is useless.

However, in the short run the foreign exchange market is in many respects very technical and it is therefore one of the markets where technical analysis historically has been used extensively. In particular, often these short run movements could be caused by investors continuously moving their funds around in a search for the highest interest rates. As it is difficult to evaluate exactly each force of the market, technical analysis is a practical alternative for trading.

Participants in the FX market

Unlike a stock market, the foreign exchange market is divided into different levels of access. At the top is the inter-bank market, which is made up of the largest commercial banks and securities dealers. Within the inter-bank market, spreads, which are the difference between the bid and ask prices, are razor sharp and not known to players outside the inner circle. The difference between the bid and ask prices widens (for example from 0-1 pip to 1-2 pips for a currencies such as the EUR) as you go down the levels of access.

For the rest several different parties participate. The most obvious participants in the FX market may be importers and exporters, tourist, and governments which spend money abroad. However, these participants account for only a very small fraction of the daily turnover in this market. In fact, and this may come as a surprise, imports and exports only account for around 1/32 of the foreign exchange turnover. The real big players are the banks, portfolio managers and other financial institutions, and international speculators. In this section we explain each of these players.

Banks

As mentioned above the FX market is special and it is to a large extent an interbank market. In fact 53% of all transactions are conducted among the biggest participating banks in what is known as the top-tier interbank market. Competition is fierce and the market is highly concentrated: the top ten dealers make up about 80% of the transactions every day. This inter-bank (or interdealer) trading is a wholesale market where blocks of $1 million are regularly exchanged. The top ten currency traders in 2009 are shown in Figure 4.

1	**Deutsche Bank**	**20,96%**
2	UBS	14,58%
3	Barclay's capital	10,45%
4	RBS	8,19%
5	Citibank	7,32%
6	J.P. Morgan	5,43%
7	HSBS	4,09%
8	Goldman Sachs	3,35%
9	Credit Suisse	3,05%
10	BNP Paribas	2,26%

Figure 4: Top ten currency traders in percentage of total volume in 2009. Source FX Poll 2009 by Euromoney.

On the retail side, that is the trade with private costumers, banks and other brokers first of all serve as intermediaries and market makers in the FX market since this is almost entirely an OTC market. Again, competition is fierce as there is not much difference between a USD bought from one or another bank. Banks acting as market makers is for instance the case when you as a private person goes to your bank and buy foreign currency. This is bought directly from the bank in general, and does not make it to the interbank market directly.[1] By 2010, retail trading was estimated to account for up to 10% of spot FX turnover, or $150 billion per day.

However, while part of the business of the banks is to deal on behalf of its clients this is in fact a very small fraction of their total trading. Today, large banks may trade billions of dollars daily, and the majority of this is conducted by proprietary desks, i.e. trading for the bank's own account. In fact, it has been estimated that for some of the big commercial banks proprietary trading accounts for up to half of their profits. A large part of this profit may in fact come from direct speculation and thus makes banks part of the second group of participants, the speculators.

Speculators

It is sometimes estimated that around 70% to 90% of the foreign exchange transactions are speculative. In other words, the person or institution that bought or sold the currency has no plan to actually take possession of the currency in the end and to keep it. Instead their positions

[1] Though there are attempts to create electronic brokering systems for FX, in the retail market these attempts are hampered by the fact that the asset, that is the currency, often has to be physically settled. I.e. when buying dollars at the bank you need the actual paper money.

are taken with the clear objective to be closed out again in the immediate future. As already mentioned, banks are oftentimes speculating actively. Another type of FX trading which is in fact implicitly induced by speculation comes from investors with spare funds who are continuously searching for the highest possible interest rates internationally. As these investors move their large sums from one country to another for speculation currencies are traded.

More recently, hedge funds have gained a reputation for aggressive currency speculation. The reason is that they control billions of dollars of equity and may borrow billions more, and thus may be capable of overwhelming any intervention by central banks to support almost any currency. While this reputation may or may not be deserved, one of the best examples of speculation was indeed that of a hedge fund manager. The man in question is George Soros, who following his bet against the British pound in 1992 became known as the man who broke the bank of England, see the Appendix.

The role of central banks

National central banks may play an important role in the foreign exchange markets by increasing or decreasing their currency reserves. However, in most of the developed countries, and in the OECD in particular, their main role is to prevent high inflation and to provide economic stability. They try to control the money supply, inflation, and/or interest rates and often have official or unofficial target rates for their currencies, and they can use their often substantial foreign exchange reserves to stabilize the market.

That said, central bank actions or even their expected action can have large influences on exchange rates, and the mere expectation or rumour of central bank intervention might be enough to destabilize a currency. Moreover, central banks do not always achieve their objectives, and the combined resources of the market can easily overwhelm any central bank. Several scenarios of this nature were seen in the 1992–93 collapse of the European Exchange Rate Mechanism and in more recent times in Southeast Asia.

FX Rates and quotes

The way prices are quoted in the FX market may at first be a bit confusing. The reason is that both the good, the currency bought, and the price is in terms of money. Thus, the USD and CAD exchange rate can be quoted either as the amount of USD to pay for one CAD or the amount of CAD to pay for one USD. However, essentially a currency is just a good like a bond, a stock, or, for that sake, a piece of cheese at the local supermarket.

Quotes

Since most FX transactions happen through the US dollar in the interbank market the “normal” way to quote the price of a currency is in terms of USD. However, this still leaves two possibilities. When the exchange rate is expressed in *European terms* the rates is quoted as the number of units of foreign currency needed to buy one USD. For example, the exchange rate between the USD and the Euro is stated as 0.8700EUR/USD, which means “0.8700 Euro per

dollar". When quoted in *American terms*, on the other hand, exchange rates are expressed as the number of units of USD to buy one unit of a foreign currency. That is, 1.1494USD/EUR, which means "1.1494 dollars per Euro".

For practical purposes currencies are quoted using three letter codes. For example US dollar is USD, Euro is EUR, and British pounds are GBP. Moreover, the general convention is to quote the exchange rates as XXXYYY where XXX denotes the good and YYY denotes the currency the price is denoted in. For example, CADUSD denotes the price of one CAD when paying with USD. The reverse rates, or the rates quoted in European terms, are simply denoted XXX. That is, CAD denotes the price of one USD when paying with CAD. While this convention holds for most currencies, for historical reasons the opposite notation is used for AUD, GBP, and EUR. Hence for these three currencies, and only for these currencies, AUD means the price of one AUD when paying with USD and USDAUD is the price of one USD when paying with AUD. Confusing – right? And even worse, this is important because AUDUSD often does not exist as a ticker and vice versa. A final and important exception is the Japanese Yen which is quoted for 100 units of the currency.

Bid and Ask

Quotes are given as a bid and ask. The bid is the price a dealer is wishing to buy another currency and the ask is the price at which a dealer will sell other currencies. So a trader will pay the ask price to buy and will receive the bid price if she sells. Consequently, ask is always superior to bid. The difference between ask and bid is called the *spread*. The spread is the remuneration to a dealer in a market making position because of bringing liquidity. The closer the spread, the more liquid is the market.

Forex Quotes

Major Currencies - Real-Time

Currency	Bid	Ask	Change	High	Low	Time	Contributor
EUR/USD	1.4083	1.4085	-0.0077	1.4195	1.4074	14:26.02	RTFX
USD/JPY	94.97	94.98	0.598	95.108	94.00	14:26.07	AIBK
GBP/USD	1.6438	1.6443	0.0037	1.6469	1.6345	14:26.01	WBLT
USD/CHF	1.0816	1.0822	0.0059	1.0833	1.0728	14:26.02	WBLT
USD/CAD	1.0847	1.0852	0.0029	1.0892	1.0795	14:26.06	WBLT
AUD/USD	0.819	0.8194	-0.0052	0.8278	0.8162	14:26.05	WBLT
EUR/JPY	133.73	133.77	0.07	134.38	132.76	14:26.01	RTFX
EUR/CHF	1.5237	1.52401	0.0003	1.5271	1.5217	14:26.04	DSTI
GBP/JPY	156.13	156.17	1.33	156.34	153.82	14:26.07	AIBK
GBP/CHF	1.7785	1.779	0.014	1.7797	1.7587	14:26.07	AIBK
CHF/JPY	87.754	87.79436	0.04	88.189	87.18	14:26.06	DSTI
NZD/USD	0.6569	0.6574	0.0017	0.6594	0.6527	14:26.06	WBLT
USD/ZAR	7.8486	7.89363	0.0002	7.9444	7.8291	14:26.06	DSTI
Gold	931.04	931.55	-6.41	940.84	929.65	14:26.07	WBLT
Silver	13.4875	13.5425	-0.2025	13.75	13.44	14:26.02	SAXO

NetDania Solution Source: Tenfore

Figure 5: Example of foreign exchange quotes. Source http://www.forex-markets.com/quotes.htm.

Figure 5 displays bid and ask for the major pairs of currency. Take for instance the USD/JPY pair, which is stated in European terms. The spread is only Japanese ¥0.01. We also see the change for the day, the high, the low, time of the latest trade and the name of the contributor. Each forex participant has a GTIS code, AIBK for instance stands for Allied Irish Bank.

Cross Rates

You can't trade all currencies this way. To exchange minor currencies, you will need most often to use a third currency. For instance, suppose that an importer in Chile needs Australian Dollars to pay purchases in Sydney. Both the Chile Peso and the Australian Dollar are quoted against the US dollar:

- Chile peso: 543.50CLP/USD
- Australian Dollar: 1.2204AUD/USD

From these the cross rate can be calculated as:

- Cross Rate is: Chile Peso / Australian Dollar = 543.5CLP/USD / 1.2204AUD/USD
  = 445.35CLP/AUD

Or reciprocally: Australian Dollar / Chile Peso = 1.2204 / 543.5 = AUD 0.0022/CLP

Cross Rate Arbitrage

Intermarket exchanges may deliver opportunities of arbitrage. One of these is to check for cross rate arbitrage. Consider the following example:

- Deutsche Bank quotes 1.4560USD/EUR
- Royal Bank of Canada quotes 1.6090CAD/EUR
- JP Morgan quotes 1.1700CAD/USD

The cross rate between RBC and JP Morgan is: $\frac{1.6090\text{CAD}/EUR}{1.1700\text{CAD}/\text{USD}}$ = 1.3752USD/EUR instead of 1.4560USD/EUR quoted by Deutsche Bank. Clearly, there is an arbitrage to be made and the steps to exploit this are the following:

- You start the operation by borrowing USD 10 000 at Deutsche Bank
- You change them for CAD at JP Morgan and you get CAD 11 700
- Then, you change the CAD for EUR at RBC to get EUR 7 271.60
- Finally, you go to Deutsche Bank to change these into USD and get USD 10 587.45 – more than enough to pay back the loan and pocket the USD 587.45 profit!

Derivatives in the foreign exchange market

In this section we will describe the main types of derivatives that exist on foreign exchange: forwards and futures, options, and currency swaps. According to the BIS the daily turnover in derivatives was approximately 2.49 trillion, or roughly 62.5% of total turnover in the FX market. Figure 6 shows the relative importance of the different types of derivatives.

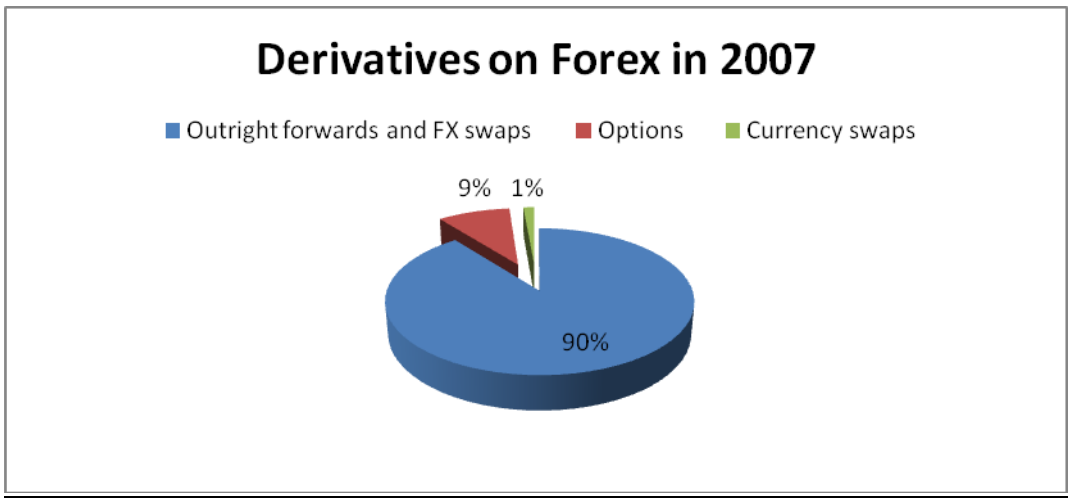


Figure 6: Overview of foreign exchange derivatives products sold in 2007. Source http://www.bis.org/publ/rpfxf07t.pdf - page 20. Note that FX swaps denotes one transaction which combines two deals – one spot and one forward deal – and is thus unlike other swaps in it classical sense.

Forwards and Futures

As it is the case in most other financial markets there are differences between the forward market and the futures market. The forward market is worldwide OTC and the main places are London and New York. The principal market for futures, on the other hand, is the International Monetary Market, or IMM, of the Chicago Mercantile Exchange, or CME.

Pricing forwards and Covered Interest Arbitrage

For the stock and index futures we have previously derived the following relationship:

$$F = S(1+r)^T.$$

For the FX forwards the relationship is instead the following:

$$F_{DC/FC} = S_{DC/FC}\left(\frac{1+r_{DC}}{1+r_{FC}}\right)^T,$$

where "DC" denotes domestic currency, "FC" foreign currency, r is the interest rate, and T the contract length. The relationship above is called the Covered Interest Rate Parity (CIRP) and if it does not hold there is the potential for arbitrage.

The argument is to consider the following two strategies

1. Place the foreign currency, FC, in a bank account to time T and enter into a forward deal for time T at rate $F_{DC/FC}$ – this results in $(1+r_{FC})^T * F_{DC/FC}$ at time T
2. Exchange the currency for DC at rate $S_{DC/FC}$ place it in a bank account until T – this results in $S_{DC/FC} * (1+r_{DC})^T$ at time T

In the absence of arbitrage this should lead to the same amount at time T:

$$(1+r_{FC})^T F_{DC/FC} = S_{DC/FC}(1+r_{DC})^T \Leftrightarrow F_{DC/FC} = S_{DC/FC}\left(\frac{1+r_{DC}}{1+r_{FC}}\right)^T$$

Foreign exchange swaps

The forward deals provide an easy way for companies to e.g. hedge against exchange rate risk. However, for the dealers and banks on the other side of the forward deals the transaction involves some problems. The reason is that such transactions essentially tie up assets and liabilities and this in terms impacts credit limits and involves counterparty risk.

The foreign exchange swap is designed to eliminate potential exchange losses resulting from adverse exchange rate movements when your foreign currency payables and receivables are due on different dates. The foreign exchange swap is one transaction which combines two deals – one spot and one forward deal. It is important to note that the FX swap is not a swap deal in its original sense where a stream of future fixed payments are "swapped" for a stream of floating payments.

We illustrate the workings of the FX swap with a small example. Thus, suppose a Canadian company is to receive USD 1 million today and knows that they will have to pay an equal amount in 3 months time. This leaves them essentially three choices:

1. They could leave the USD in an account – but that ties up funding
2. They could buy spot CAD but then they face exchange rate risk in three months time
3. They can enter into a simultaneous deal with a spot sale of USD and forward buy of the same amount of CAD in 3 months

The third choice is a foreign exchange swap. This type of contract enables the company to temporarily convert the foreign exchange into local exchange for better use of company liquidity.

Futures on foreign exchange

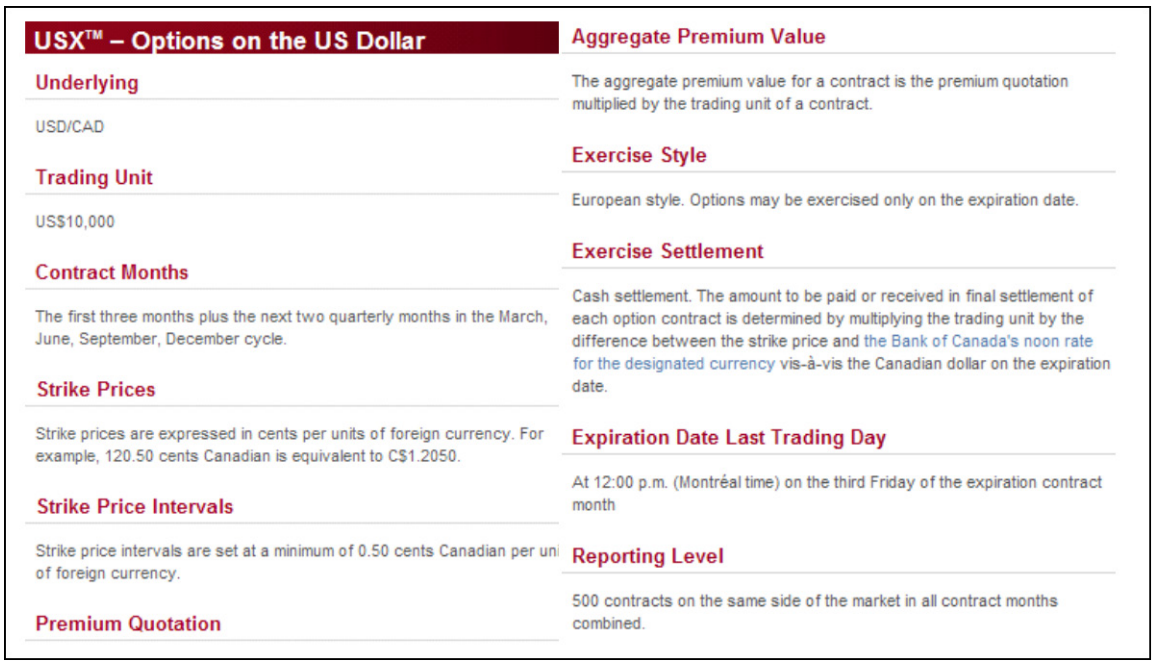
Besides the OTC traded forwards a relatively large and liquid market exists for exchange traded futures contracts. Several of these are traded at the CME with the Euro futures being by far the most traded. The Euro futures are for 125.000 Euros with physical delivery. Again we note that if interest rates can be assumed to be constant, and in this case both the domestic and the foreign rate, the futures price equals the forward price.

Options on foreign currency

Foreign currency options come in two different formats: options on the spot rate and options on the futures contracts. The latter of these are often traded at the exchanges were also the futures trade, and though there is generally less liquidity in the option market than in the futures market the volume is significant in for example the Euro options traded at the CME. Both American and European style options are traded. These options can be priced using e.g. the Black model (see Black (1976)).

Options on the spot exchange rate can also be priced using a Black & Scholes type formula. In particular, as shown by Garman & Kohlhagen (1983) to price this type of options the dividend yield in the basic model is replaced by the foreign interest rate. When considering the forward

spot parity this should make sense to you. In Canada this type of options is traded at the Montreal Exchange.



USX™ – Options on the US Dollar

Underlying

USD/CAD

Trading Unit

US$10,000

Contract Months

The first three months plus the next two quarterly months in the March, June, September, December cycle.

Strike Prices

Strike prices are expressed in cents per units of foreign currency. For example, 120.50 cents Canadian is equivalent to C$1.2050.

Strike Price Intervals

Strike price intervals are set at a minimum of 0.50 cents Canadian per uni of foreign currency.

Premium Quotation

Aggregate Premium Value

The aggregate premium value for a contract is the premium quotation multiplied by the trading unit of a contract.

Exercise Style

European style. Options may be exercised only on the expiration date.

Exercise Settlement

Cash settlement. The amount to be paid or received in final settlement of each option contract is determined by multiplying the trading unit by the difference between the strike price and the Bank of Canada's noon rate for the designated currency vis-à-vis the Canadian dollar on the expiration date.

Expiration Date Last Trading Day

At 12:00 p.m. (Montréal time) on the third Friday of the expiration contract month

Reporting Level

500 contracts on the same side of the market in all contract months combined.

Figure 7: Example of currency options on the spot rate from the Montreal Exchange.

Considering what you should know about the determinants of an option price the price depends on several factors: current spot rate, maturity remaining, exchange rate volatility, and the domestic as well as the foreign interest rates. Thus, when trading currency options traders are exposed to all of these factors.

Currency swaps

In a currency swap, a company and a bank (or another company) agree to exchange – to swap – an amount in one currency in another currency after a certain period of time or at periodic moments. A swap dealer is acting as a middleman. Note that the foreign exchange swap we discussed before has nothing to do with the market for interest rate swaps or currency swaps. The currency swap instead is the FX equivalent of the basic plain vanilla swap deal.

In the simplest possible case the currency swap involves an agreement to swap a given fixed interest rate payment in one currency for a given and, potentially different, fixed interest rate payment in another currency. Sometimes the notional amount is also swapped at the beginning and at the end of these payments. Thus, whereas the uncertainty in an interest rate swap comes from future floating rates, the uncertainty in a currency swap comes from the fact that the exchange rates change and hence the fixed payment in foreign currency has an uncertain value in local currency.

The above swap is an example of what is known as a fixed for fixed swap, i.e. the interest rate payments are fixed and the only uncertainty comes from the exchange rate. However, as should be well known this uncertainty can be hedge using the forward rates and hence a price can be calculated. And since hedging and pricing are basically the same we can also price the product.

Other types of swaps

What about a fixed for floating swap, i.e. a swap which pays a floating rate in foreign currency. How can we price this product? The answer is simple and consists of two steps. First of all, we hedge the interest rate risk in the foreign currency using either forward contracts or a regular interest rate swap denoted in this currency. Secondly, the corresponding fixed interest rate payments can then be hedged and priced using the forward exchange rates. It is as simple as this and the same procedure can be used to price floating for fixed or even floating for floating swaps!

Differential swap (an example of a quanto swap)

A differential swap is an example of a currency swap which is not easy to hedge or price. In the most basic specification, a differential swap, or a diff swap, pays the difference between the floating interest rate in two different countries applied to a notational amount in one of the currencies. The reason that this swap cannot be easily hedged is that there does not exist instruments which can be used to hedge the interest risk when applied to a different currency, for example the US interest rate applied to Canadian dollars.

Trading in the foreign exchange market

As is always the case the derivatives market can be used for arbitrage, hedging, and for speculating. In this section we explain how the various derivatives can be used for these different purposes.

Forward trading

As Figure 6 shows approximately 90% of the trading volume involves forward contracts either individually or as part of FX swaps. Forward contracts are either used for FX swaps, for CIRP arbitrage, or for hedging.

The covered interest rate parity

When the covered interest rate parity does not hold there is the potential for arbitrage. We illustrate this with a small example:

- Suppose $S_{DC/FC}=0.6225$, $r_{DC}=5\%$, $r_{FC}=6\%$ and $F_{DC/FC}=0.6325$.
- Then the CIRP requires that $F^{*}_{DC/FC}=0.6166$

Strategy: sell the expensive currency and buy the cheap currency!

- Thus, you sell the forward at 0.6325 “requiring” you to buy 0.6325 DC for a FC or equivalently to sell one FC for 0.6325 DC’s each

- You buy through the CIRP by borrowing one DC at time T for 1/(1+0.05), change the 1/(1+0.05) into FC for 1/0.6225 and let it accumulate in the bank to 1/(1+0.05)*1/0.6225*(1+0.06)=1.6217FC
- At time T you sell the 1.6217FC for 0.6325DC/FC resulting in a total of 1.0257DC of which you owe 1DC to the bank. You have made a nice – and completely risk free – profit of 0.0257DC

This type of arbitrage is illustrated in Figure 8.

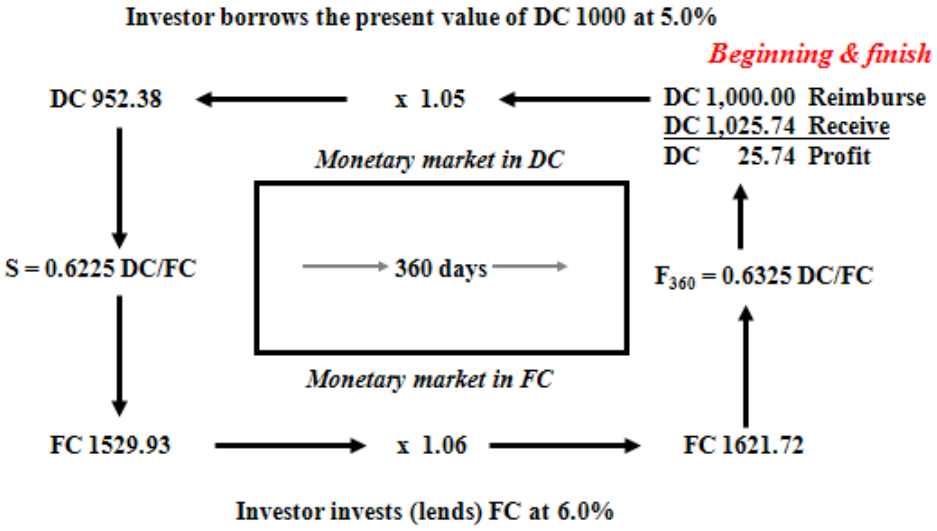


Figure 8: An illustration of the workings of arbitrage.

Of course, it works the other way around.

Cash and carry and reverse cash and carry

The strategy used in the covered interest arbitrage before is called cash and carry. This refers to a situation where the "asset" S can actually be bought – e.g. when it is a stock. In this respect there is a cost of carry – because money is tied up in the asset – compared to the futures/forward. However, remember that you now have to take account of bid-ask spreads. And this holds not only for the FX rates but also for the interest rates. Since bids are lower than asks this puts extra restrictions on when arbitrage is possible. The cash and carry involves the following trades:

- ☐ Buy AUD spot and AUD bonds
- ☐ Sell forward AUD and USD bonds
- ☐ Restriction: $$F^{Bid}_{USD/AUD} > S^{Ask}_{USD/AUD}\left(\frac{1+r^{Ask}_{USD}}{1+r^{Bid}_{AUD}}\right)$$

The reverse cash and carry works in, well, the opposite way. This involves the following:

- ☐ Sell AUD spot and AUD bonds
- ☐ Buy forward AUD and USD bonds
- ☐ Restriction: $F^{Ask}_{USD/AUD} < S^{Bid}_{USD/AUD}\left(\frac{1+r^{Bid}_{USD}}{1+r^{Ask}_{AUD}}\right)$

Both of these trades are extensively used.

Speculation with futures

Exchange traded futures can either be used to take directional bets or to trade spreads. The directional bets follow the same logic as buying the actual spot, though they are less expensive to implement as less payments are made up front. As an illustration, suppose we have the following spot and futures prices on the $/€ pair:

Foreign exchange prices : spot and futures, April 7 ($/€)	
Spot	1.2321
JUN Futures	1.2449
SEP Futures	1.2533
DEC Futures	1.2756

We can see the market is expecting an appreciation (a rise) of the euro against the US dollar. Now our speculator expects depreciation (a fall) of the euro over the next few months. So, she sells the December futures contract at 1.2756. Let us assume that on December 10, the spot price is = 1.2533, i.e. it has actually fallen. The December futures contract is quoted 1.2554. So the profit per euro is: 1.2756 – 1.2554 = $0.0202. With a contract valued at €125,000 the total profit is $2,525 (125,000 * 0.0202).

Instead of speculating with an outright position, the investor can choose to trade the spread. This is just like trading spreads in the fixed income market. It decreases the exposure to overall movements in the exchange rate if all the investor wants is to have exposure to the spread between different maturities. To illustrate the workings of spread trades suppose we have the following constant prices on the $/£ pair:

Foreign exchange prices : spot and futures, August 12 ($/£)	
Spot	1.4485
SEP Futures	1.4480
DEC Futures	1.4460
MAR Futures	1.4460
JUN Futures	1.4470

Suppose the investor believes the spread between the December and March futures will widen. The appropriate strategy to implement is the following:

August 12: Buy one DEC £ futures contract at 1.4460

Sell one MAR £ futures contract at 1.4460

Now suppose that on December 5, the December futures contract is quoted at 1.4313 and the March futures contract is quoted at 1.4253.

December 5: Sell one DEC £ futures contract at 1.4313

Buy one MAR £ futures contract at 1.4253

Profit for the December contract: 1.4314 – 1.4460 = -$0.0147

Profit for the March contract: 1.4460 – 1.4253 = $0.0207

Total profit = $0.006 per £. So for a £65,000 total profit is $390.

Hedging

Many investors and companies find themselves expose to foreign exchange risk. That risk is a measure of the potential variation of revenues, net cash flows and stock value of a firm. The treasurer aims to measure this exposure and to manage it. The following is an example with hedging in the forward market:

A Canadian firm imports components for its manufacturing process from the US. The company is expecting a large shipment three months from now, at which a payment of US$3,000,000 will be required. Concerned about a possible appreciation in the USD, the CFO decides to hedge this short USD position. The CFO can buy US dollars for delivery in three months at 1.5890. Once the forward contract is in place, the CFO knows with certainty that the shipment of components will cost CA$4,760,000 (3,000,000 * 1.5890), regardless of exchange-rate movements in the forthcoming months.

Speculating with currency options

The strategies used are the same than for the stocks, we can divide them in two categories. In addition to this several types of exotic options exist, each of which allow investors to speculate further.

Spreads

This category of trades involves options of the same nature (either calls or puts), with the same maturity but different strike prices. We can mention Bull Spread and Bear Spread

Combinations

This category of trades involves options of different nature, with the same maturity and the same strike price. We can mention Straddle (long and short), Strangle (long and short), Butterfly and Condor.

Exotic Options

In the foreign exchange market several types of exotic options have been developed, each of has been created to respond to specific needs. Below we present the most frequent exotic options used in the foreign exchange market. Exotic options represent 10% of the options traded, and 90% of them are barrier options.

Barrier options: It could a knock-in or a knock-out barrier. When the spot price goes through a knock-in level (a trigger), the option becomes a vanilla option. If it is a knock-out level, the option expires.

They are relatively easy to price with the Black and Scholes model but quite difficult to manage. The delta and gamma are very volatile. The advantage is that they are cheaper than vanilla options.

Average rate options (or Asian options): Exercising this option depends on the average course of the currency during its lifespan. This is also a path-dependent option.

Asian options may be used by companies to match streaming cash-flows over a period. They are cheaper than a strip of vanilla options (rolling over following options). The volatility of the option is lower than the underlying.

Quantos: It s a two-asset option. One asset is in a foreign economy and its price is in the foreign currency. The other asset is the exchange rate between the domestic and foreign currencies. It is a kind of currency-foreign-asset hybrid.

Other ways to obtain exposure to foreign exchange - the international bond market

The international bond market is yet another area of finance where innovation is unlimited and where a vast pool of securities allows issuers and investors to benefit from international diversification. Although both standard and exotic instruments coexist within this broad market, we are generally able to classify any international bond into two major categories: *foreign bonds* and *Eurobonds*.

Foreign Bonds

Foreign bonds are bonds issued on a local market and sold to local investors by a foreign borrower. These bonds are subject to local regulation, structured by local underwriters and the currency used is the local currency where the bonds are issued. For example, if the province of Ontario were to issue bonds in USD in the United States, they would be considered foreign bonds. These bonds carry commonly used nicknames which vary by country of issuance. In the United States, foreign bonds are referred to as Yankee bonds; in Japan they are known as Samurai bonds; in the UK, Bulldog bonds; in Australia, Kangaroo bonds; in Canada, Maple bonds; and in New Zealand, Kiwi bonds.

Eurobonds

Eurobonds are bonds issued in a country or in different countries other than the one in which currency the issue is denominated in. For example, if the province of Ontario were to issue and sell bonds in Japan but denoted in CAD, they would be considered Eurobonds. Such bonds are normally underwritten by an international syndicate and fall outside the legislation of the country where they are issued. This makes them attractive to issuers as less time is spent on specific disclosure requirements, and more importantly, since issuance costs are generally lower. Eurobonds are usually *bearer bonds*, meaning they are not registered and therefore the investors' names are not recorded. As a result, interest payments are not disclosed to the authorities and thus no taxes are paid on interest. Eurobonds are generally medium to long term and seldom suffer from low liquidity, which negatively impacts their bid-ask spreads.

Trading, Hedging and Investing

As international bonds are valued the same way as standard domestic bonds, they offer the same predictive revenue streams. Whether for foreign exchange hedging purposes, international portfolio diversification, or pure speculation on foreign currencies or interest rates, international bonds are extensively used by investors throughout the world.

From the issuer's point of view, one of the main reasons to tap the international bond market remains the attempt to lower financing costs. A widely used strategy is to couple the issuance with the use of derivative instruments - such as forwards or swaps - to replicate the cash flows of the bonds and thus to nullify any foreign exchange risk. For example, the province of Ontario could weigh the cost of a domestic bond issuance against that of a foreign bond issuance where – in using a series of swaps – the payments would be transferred back into CAD. This comparison would allow the province to select the least expensive option.

Foreign bonds are also of interest to issuers with incoming cash flows in a foreign currency. By issuing bonds in this specific currency, an issuer can hedge its foreign exchange risk by redistributing these foreign cash flows in terms of foreign coupon and principal payments. Even without foreign currency exposure, issuers may have their own views on future movements in international currencies, and issue bonds where they believe the currency is likely to depreciate.

Conclusion

The foreign exchange market (forex, FX, or currency market) is a worldwide decentralized over-the-counter financial market for the trading of currencies. The foreign exchange market determines the relative values of different currencies. The foreign exchange market is the most liquid market, it is open 24 hours a day except for weekends, and it is extremely efficient with low trading costs.

In addition to the spot rates traders use forwards, futures, options, and swaps to arbitrage, hedge, and speculate. In fact, derivatives account for 62.5% of the total daily turnover. In many respects this market is similar to the derivatives market for other assets. One exception though

is the FX swap, which is not a swap in its classical sense. Instead the FX swap denotes simultaneously trading the spot and a forward contract. The classical swap is instead called a currency swap.

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Wikipedia (various search terms)

CME group homepage @ www.cmegroup.com

Appendix: George Sores – the man who broke the Bank of England

On September 16, 1992, a date which has since then become known as the Black Wednesday in Britain, George Soros's fund sold short more than USD10 billion worth of pounds. The goal of this trade was to profit from the UK Government's reluctance to raise its interest rates to levels comparable to those of other European Exchange Rate Mechanism countries while at the same time attempting to keep its currency pegged to the basket of European currencies. The bet paid of as the UK withdrew from the European Exchange Rate Mechanism, devaluing the pound sterling. On his short position, Soros is estimated to have earned USD1.1 billion. Following this event he was dubbed "the man who broke the Bank of England".

Preface

Though Britain, along with several other members of the European Union, had decided not to join the European Exchange Rate Mechanism, or ERM, when it was set up in 1979, the authorities had adopted at least a semi-official policy of pegging the pound to the Deutsche Mark. On October 1990 the British Government announced that it would follow an economic and monetary policy that would prevent the exchange rate between the pound and other member currencies from fluctuating by more than 6%. The pound entered the ERM mechanism at DM 2.95 to the pound. Hence, if the exchange rate ever neared the bottom of its permitted range, DM 2.778, the government would be obliged to intervene.

However, at the beginning of the 1990s the German Bundesbank decided to increase interest rates to counteract inflationary effects related to excess expenditure on German reunification.

This in terms caused significant stress across the whole of the ERM. The UK was hit particularly hard by this as it was not only running double deficits but was also hit by a depreciation of the US dollar, the main currency of it exports.[2] The last straw was the added uncertainty resulting from the rejection of the Maastricht Treaty at the Danish referendum in the spring of 1992 and the following announcement that there would be a referendum in France as well. The result was to add pressure on the currencies, in particular the pound, which were trading close to the bottom of their ERM bands. Foreign exchange traders began to sell massive amounts of pounds hoping to buy them back at a lower price, i.e. a lower exchange rate, later.

Breaking the Bank of England

The UK's prime minister and cabinet members tried vehemently to prop up a sinking pound and to convince the markets that a withdrawal from the monetary system the country had joined two years prior was the last resort. Prime Minister Major raised interest rates to 10% and authorised the spending of billions of pounds to buy the sterling being frantically sold on the currency markets. However, the sell-of of pounds continued and all these measures failed to prevent the pound from falling lower than its minimum level in the ERM.

On 16 September the British government announced a rise in the base interest rate from an already high 10% to 12% in order to tempt speculators to buy pounds. Despite this and a promise later the same day to raise base rates again to 15%, dealers kept selling pounds, convinced that the government would not stick with its promise having lost confidence in the British government. By 19:00 that evening, it was announced that Britain would leave the ERM and that interest rates would remain at the new level of 12%. During the following days the pound quickly dropped to around DM 2.40.

Epilogue

In 1997, the UK Treasury estimated the cost of Black Wednesday to Britain at £3.4 billion. In fact, while the trading losses in August and September were estimated at £800 million, the main loss to taxpayers arose because the devaluation, as it was bound to happen, could in fact have been profitable for Britain. For example, if the government had maintained its USD24 billion foreign currency reserves and the pound had fallen by the same amount, the UK would have made a USD2.4 billion profit on the pound's devaluation.

For George Sores the rumour as the man who broke the Bank of England followed him and since then his actions have been followed closely. In 1997, during the Asian financial crisis, the Prime Minister of Malaysia Mahathir bin Mohammad accused Soros of using the wealth under his control to punish the Association of Southeast Asian Nations (ASEAN) for welcoming Myanmar as a member.

(Source: Wikipedia)

[2] A double deficit is when a country is running deficits both internationally, on trade, and domestically, on the government spending.

Appendix: The Big Mac index

The Big Mac Index is published by The Economist as an informal way of measuring the purchasing power parity (PPP) between two currencies and provides a test of the extent to which market exchange rates result in goods costing the same in different countries. The Big Mac index was introduced in September 1986 by Mark Czwierdzinski as a semi-humorous illustration and has been published by that paper annually since then. The index has since then given rise to the word "burgernomics".

Idea

The general idea behind the Big Mac index is that a basket of similar products in one country should cost the same in a given currency as that basket costs locally. If not, there is scope for trading. Thus, in the long run exchange rates should adapt such that a dollar buys the same in all countries. The "basket" could be anything and The Economist chose the Big Mac since this is a relatively standardized product which is produces it a large number of countries.

The Big Mac PPP exchange rate between two countries is obtained by dividing the price of a Big Mac in one country in its local currency by the price of a Big Mac in another country in this country's local currency. This value is then compared with the actual exchange rate; if it is lower, then the first currency is under-valued (according to PPP theory) compared with the second, and conversely, if it is higher, then the first currency is over-valued.

For example, using figures in July 2008 the Big Mac index is calculated as follows:

- the price of a Big Mac was USD3.57 in the United States
- the price of a Big Mac was GBP2.29 in the United Kingdom
- the implied purchasing power parity was USD3.57/GBP2.29 = 1.56USD/GBP

The actual exchange rate at this time was 2USD/GBP. Compared to the implied burger exchange rate this is 28% higher, (2.00-1.56)/1.56 = 0.28, and hence at this time the GBP was thus overvalued against the USD by 28%.

Limitations

The burger methodology has limitations in its estimates of the PPP. The first and most important reason is that there is in fact no theoretical reason that the cost of a non-tradable difficult to transport good should be the same in different countries. Secondly, though relatively standard as a product the Big Mac does in fact vary from country to country in terms of e.g. weight and size. Moreover, not all Big Macs are made of beef. For example, in India, which is a predominantly Hindu country, the chicken Maharaja Mac is used instead of the actual Big Mac. Thirdly, eating in fast-food restaurants such as McDonald's is in fact in some countries relatively expensive in comparison to eating in other restaurants and therefore the relative demand for the product varies a lot from country to country. Again, there is not that much demand for Big Macs in India! Finally, the price of a Big Mac may reflect other things than just the costs of producing the burger. In fact, the pricing policies of the restaurant may vary a lot from one

country to another. Nevertheless, economists widely cite the Big Mac index as a reasonable real-world measurement of purchasing power parity.

Other variants

The Economist sometimes produces variants on the theme. For example in January 2004, it showed a Tall Latte index with the Big Mac replaced by a cup of Starbucks coffee. Bloomberg L.P. introduced the Billy index where they convert local prices of Ikea's Billy bookshelf into USD and compare the prices.

In 2007, an Australian bank's subsidiary, Commonwealth Securities, adapted the idea behind the Big Mac index to create an "iPod index." The bank's theory is that since the iPod is manufactured at a single place, the value of iPods should be more consistent globally. However, this theory can be criticised for ignoring shipping costs, which will vary depending on how far the product is delivered from its "single place" of manufacture in China.