

## Introduction

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This chapter discusses how changes in exchange rates can lead to an increase in uncertainty about income from operations in foreign countries or from trading with foreign firms. Shifts in foreign exchange rates have the potential to undermine the competitive position of the firm and destroy profits. This chapter describes some of the techniques used to reduce the risk associated with business dealings outside the home base.

### Case study 21.1

#### What a difference a few percentage point moves on the exchange rate make

Until autumn 1992 sterling was a member of the European exchange rate mechanism (ERM), which meant the extent it could move in value *vis-à-vis* the other currencies in the ERM was severely limited. Then came 'Black Wednesday' when in order to prop up the value of sterling the UK government increased bank base rates to 15 percent and instructed the Bank of England to buy billions of pounds to offset the selling pressure in the markets. It was all to no avail. The pound fell out of ERM, the government gave up the fight, and by the end of the year £1 could only buy you about DM2.35 compared with DM2.90 in the summer (a 19 percent decline).

George Soros was one of the speculators who recognized economic gravity when he saw it, and bet the equivalent of \$10bn against sterling by buying other currencies. After the fall the money held in other currencies could be converted back to make \$1bn in just a few days. He was dubbed the man who 'broke the Bank of England'. While this was not exactly true, he and others did cause severe embarrassment.

When sterling was highly valued against other currencies exporters found life very difficult because, to the foreign buyer, British goods appeared expensive – every DM, franc or guilder bought few pounds. However in the four years following 'Black Wednesday' UK exporters had a terrific boost and helped pull the economy out of recession as overseas customers bought more goods. Other European companies, on the other hand, complained bitterly. The French government was prompted by its hard-pressed importers to ask for compensation from the European Commission for the 'competitive devaluations by their neighbours'. Then things turned around. Between 1996 and 2001 the pound rose against most currencies. For example, whereas you could buy only DM2.2 at the beginning of 1996 by 2001 you could buy DM3.09 for every pound. Looked at from the German importers' viewpoint UK goods relative to domestic goods rose in price by something of the order of 30–40 percent.

UK firms lined up to speak of the enormous impact the high pound was having on profits. British Steel (Corus) cut thousands of jobs in response to sterling's rise and started losing money at an alarming rate. It also passed on the pain by telling 700 of its UK suppliers to cut prices.

James Dyson, the vacuum cleaner entrepreneur, announced in 2000 that he was planning to build a factory in East Asia rather than Britain because of the strength of the pound. In the previous year Dyson had made a loss on its £60m of exports. The Japanese car makers, Toyota, Honda and Nissan, which had established plants in Britain, complained bitterly about the high level of the pound. Their factories were set up to export cars. They were hurt by

having to reduce prices and also by their commitment to buy 70 percent of components from UK suppliers (continental European suppliers benefited from a 30–40 percent price advantage because of the high pound).

Then things turned around again. The euro shot up against the pound over the period 2002 to 2004. European companies had a very hard time trying to export, particularly into the US market because the dollar had declined against the euro by around 30 percent making European goods 30 percent more expensive in the eyes of US consumers. Worse, US exporters could compete against their European rivals more effectively when selling to countries in Asia and elsewhere because of the rise in the euro. EADS, the company that holds 80 percent of Airbus, in 2004 announced that the weakness of the dollar could wipe out €3 billion off profit. All commercial jet revenues are booked in dollars, while 50 percent of its cost base is in euros. As a way of coping it is considering sourcing more inputs from dollar zone countries and the relocation of manufacturing for new products; these moves could have profound effects on employment in continental Europe and the UK (e.g. British Aerospace supplies wings to Airbus).

The message from the ups and downs of sterling and other currencies in the last dozen years is that foreign exchange shifts and the management of the associated risk are not issues to be separated and put into a box marked ‘for the attention of the finance specialists only’. The profound implications for jobs, competitiveness, national economic growth and firms’ survival mean that all managers need to be aware of the consequences of foreign exchange rate movements and of how to prepare the firm to cope with them.

## The impact of currency rate changes on the firm

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Shifts in the value of foreign exchange, from now on to be referred to as simply ‘forex’ (FOReign EXchange),<sup>1</sup> can impact on various aspects of a firm’s activities:

- *Income to be received from abroad* For example, if a UK firm has exported goods to Canada on six months’ credit terms, payable in Canadian dollars (C\$), it is uncertain as to the number of pounds it will actually receive because the dollar could move against the pound in the intervening period.
- *The amount actually paid for imports at some future date* For example, a Japanese firm importing wood from the USA may have a liability to pay dollars a few months later. The quantity of yen (¥) it will have to use to exchange for the dollars at that point in the future is uncertain at the time the deal is struck.
- *The valuation of foreign assets and liabilities* In today’s globalized marketplace many firms own assets abroad and incur liabilities in foreign currencies. The value of these in home-currency terms can change simply because of forex movements.

- *The long-term viability of foreign operations* The long-term future returns of subsidiaries located in some countries can be enhanced by a favorable forex change. On the other hand firms can be destroyed if they are operating in the wrong currency at the wrong time.
- *The acceptability, or otherwise, of an overseas investment project* When evaluating the value-creating potential of major new investments a firm must be aware that the likely future currency changes can have a significant effect on estimated NPV.

In summary, fluctuating exchange rates create risk, and badly managed risk can lead to a loss of shareholder wealth.

## Volatility in foreign exchange

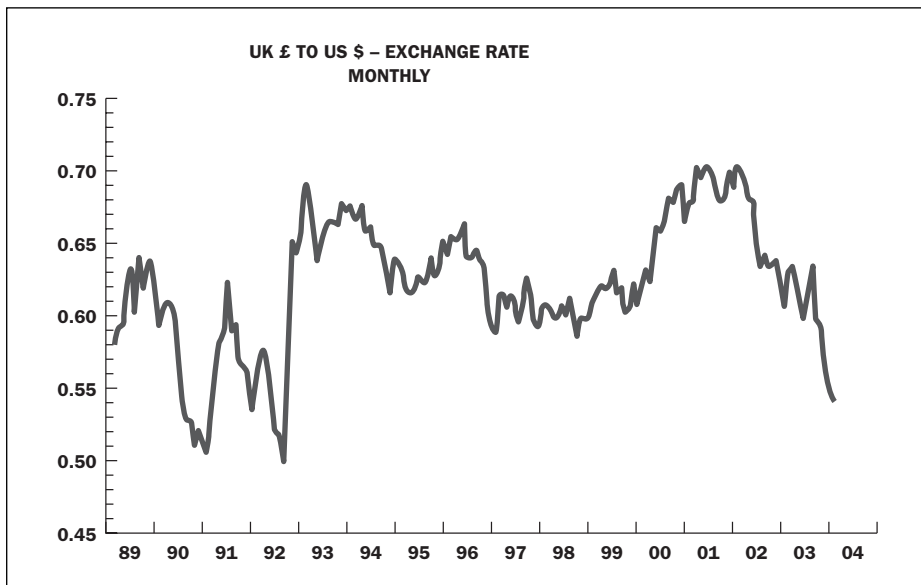
Figures 21.1 and 21.2 show the extent to which forex rates can move even over a period as short as a few weeks – 5 or 10 percent point shifts are fairly common.

In the mid-1970s a regime of (generally) floating exchange rates replaced the fixed exchange-rate system that had been in place since the 1940s. Today most currencies fluctuate against each other, at least to some extent.

If a UK firm holds dollars or assets denominated in dollars and the value of the dollar rises against the pound a forex profit is made. Conversely, should the pound rise relative to the dollar, a forex loss will be incurred. These potential

**FIGURE 21.1**

**Exchange-rate movements, UK£ to US\$, March 1989–March 2004 (monthly)**



Source: Thomson Financial Datastream

**FIGURE 21.2****Exchange-rate movements, Euro to UK£, March 1999–March 2004 (monthly)**

Source: Thomson Financial Datastream

gains or losses can be very large. For example, between March 1992 and February 1993 the dollar appreciated by 17.8 percent against the pound so you could have made a large gain by holding dollars even before the money was put to use, say, earning interest. In other periods fluctuating forex rates may wipe out profits from a project, an export deal or a portfolio investment (for example, a pension fund buying foreign shares).

## The currency markets

The function of the forex markets is to facilitate the exchange of one currency into another. This market has grown dramatically. In 1973 the equivalent of US\$10bn was traded around the globe on average each day. By 1986 this had grown to US\$300bn, and just three years later, by 1989, this had more than doubled to US\$590bn. In 1998 the daily turnover was over US\$1,490bn. In 2001 it was estimated at \$1,210bn.<sup>2</sup> London is the biggest currency trading center in the world, with US\$504bn traded daily in 2001. The US traded US\$254bn. Japan traded US\$147bn and Singapore comes in fourth place trading US\$101bn per day.

**London is the biggest currency trading center in the world.**

To put the figures in perspective consider the total output of all the people in the UK in one day (GDP): this amounts to around US\$4bn – less than one percent of the value of the currency that changes hands in London in one day. In the USA the forex turnover is nine times daily production.

In 2001 the euro entered on one side of 38 percent of all foreign exchange transactions, whereas the dollar was on one side in 90 percent of cases. The yen was on one side of 23 percent of trades and sterling was involved in only 13 percent of trades.

## Who is trading?

The buyers and sellers of foreign currencies are:

- exporters/importers
- tourists
- fund managers (pensions, insurance companies, etc.)
- governments (for example, to pay for activities abroad)
- central banks (smoothing out fluctuations)
- speculators
- banks.

The first five groups account for only a small fraction of the transactions. The big players are the large commercial banks. In addition to dealing on behalf of customers, or acting as market makers, they carry out ‘proprietary’ transactions of their own in an attempt to make a profit by taking a position in the market – that is, speculating on future movements. Companies and individuals usually obtain their foreign currencies from the banks.

**The big players are the large commercial banks.**

Foreign exchange interbank brokers often act as intermediaries between large buyers and sellers. They allow banks to trade anonymously, thus avoiding having the price move simply because of the revelation of the name of a bank in a transaction.

Most deals are still made over the telephone and later confirmed in writing. However the new electronic trading systems in which computers match deals automatically have taken a rapidly increasing share of deals.

## Twenty-four hour trading

Dealing takes place on a 24-hour basis, with trading moving from one major financial center to another. Most trading occurs when both the European and New York markets are open – this is when it is afternoon in Frankfurt, Zurich and London and morning on the east coast of the Americas. Later trade passes to San Francisco and Los Angeles, followed by Wellington, Sydney, Tokyo, Hong Kong, Singapore and Bahrain.

Most banks are in the process of concentrating their dealers in three or four regional hubs. These typically include London as well as New York and two sites in Asia, where Tokyo, Hong Kong and Singapore are keen to establish their dominance.

The vast sums of money traded every working day across the world means that banks are exposed to the risk that they may irrevocably pay over currency to a counterparty before they receive another currency in return because settlement systems are operating in different time zones. A bank could fail after receiving one leg of its foreign exchange trades but before paying the other leg – this is called Herstatt risk after a German bank that failed in 1974 leaving the dollars that it owed on its foreign exchange deals unpaid. Its failure caused panic and gridlock in the forex market, which took weeks to unravel. A new organization, the CLS Bank, will allow both legs of the trade to be paid simultaneously, eliminating the risk that one bank might fail in midstream. Under CLS, payments will be made by banks to an orderly schedule in a five-hour slot the day after the deal. A second major advantage of this system is that the net value of the trades are settled rather than the gross amounts of trades. So if a bank sold \$1bn, but also bought \$900m, the settlement is for only \$100m.

**Under CLS, payments will be made by banks to an orderly schedule in a five-hour slot the day after the deal.**

## Exchange rates

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We now look more closely at exchange rates, starting with some terms used in forex markets. First, we provide a definition of an exchange rate:

An exchange rate is the price of one currency expressed in terms of another.

Therefore if the exchange rate between the US dollar and the pound is  $\text{US\$}1.89 = \text{£}1.00$  this means that  $\text{£}1.00$  will cost  $\text{US\$}1.89$ . Taking the reciprocal,  $\text{US\$}1.00$  will cost 52.91 pence. The standardized forms of expression are:

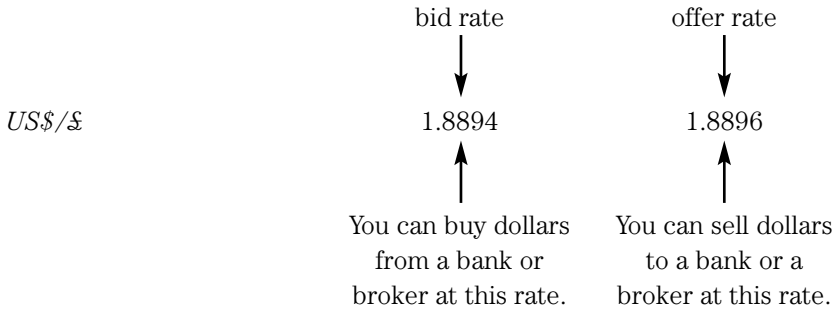
US\$1.89/£  
or  
US\$/£ : 1.89

Exchange rates are expressed in terms of the number of units of the first currency per single unit of the second currency. Also forex rates are normally given to five or six significant figures. So for the US\$/£ exchange rate on 19 February 2004 the more accurate rate is:

US\$1.8895/£

However this is still not accurate enough because currency exchange rates are not generally expressed in terms of a single ‘middle rate’, but are given as a rate at which you can buy the first currency (bid rate) and a rate at which you can sell the first currency (offer rate). In the case of the US\$/£ exchange rate the market rates on 19 February 2004 were:

US\$1.8895/£ 'middle rate'



So if you wished to purchase US\$1m the cost would be:

$$\frac{\$1,000,000}{1.8894} = \pounds 529,269$$

However if you wished to sell US\$1m you would receive:

$$\frac{\$1,000,000}{1.8896} = \pounds 529,213$$

The foreign exchange dealers make profit in two ways. First, they may charge commission on a deal. Depending on the size of the transaction this can vary, but it is generally well below 1 percent. Second, these institutions are dealing with numerous buyers and sellers every day and they make a profit on the difference between the bid price and offer price (the bid/offer spread). In the above example if a dealer sold US\$1m and bought US\$1m with a bid/offer spread of 0.02 of a cent, a profit of  $\pounds 529,269 - \pounds 529,213 = \pounds 56$  is made.

## The spot and forward exchange markets

There are two main forex markets.

- *The 'spot' market* In the spot market transactions take place which are to be settled quickly. Officially this is described as immediate delivery, but this usually takes place two business days after the deal is struck. However, this is reduced to the next morning (Greenwich mean time) for those trades going through CLS.
- *The 'forward' market* In the forward market a deal is arranged to exchange currencies at some future date at a price agreed now. The periods of time are generally one, three or six months, but it is possible to arrange an exchange of currencies at a pre-determined rate many years from now.

Forward transactions represent about one-third to one-half of all forex deals. There are many currencies, however, for which forward quotes are difficult to obtain. The so-called exotic currencies generally do not have forward rates quoted by dealers. These are currencies for which there is little trading

demand to support international business, etc. On the other hand, spot markets exist for most of the world's currencies.

**Spot markets exist for most of the world's currencies.**

The *Financial Times* reports the previous day's trading in the forex market. The figures shown in Exhibit 21.1 relate to dealing on 19 February 2004. Of course by the time a newspaper reader receives the information in this table the rates have changed as the 24-hour markets follow the sun around the world.

The prices shown under the pound columns in Exhibit 21.1 are the middle price of the foreign currency in terms of £1 in London the previous afternoon.<sup>3</sup> So, for instance, the mid price of £1 for immediate delivery is 2.3953 Australian dollars. For the US dollar columns the prices for the pound and euro are the number of dollars per currency unit, either per pound or per one euro. However for other currencies the rate shown is the number of units of the other currency per US\$1 – for example, 1.3325 Canadian dollars per US dollar. For the euro columns the rate shown is the number of units of the other currency per euro – for example the spot mid-rate against the pound is 67.09 pence per euro.

The first forward price (middle price) is given as the 'one month' rate. So you could commit yourself to the sale of a quantity of dollars for delivery in one month at a rate that is fixed at about US\$1.8850 per pound. In this case you will need fewer US dollars to buy £1 in one month's time compared with the spot rate of exchange, therefore the dollar is at a *premium* on the one-month forward rate.

The forward rate for one month shows a different relationship with the spot rate for the South African rand against the pound. Here more rands are required (R12.5816) to purchase £1 in one month's time compared with an 'immediate' spot purchase (R12.5326), therefore the rand on one-month forward delivery is at a *discount*.

The *Financial Times* table lists quotations up to one year, but, as this is an over-the-counter market (see Chapter 20), you are able to go as far forward in time as you wish – provided you can find a counterparty. For some currencies trading in three-month and one-year forwards is so thin as to not warrant a quotation in the table. However for the major currencies such as the US dollar, sterling, the euro, the Swiss franc and the Japanese yen, forward markets can stretch up to ten years. Airline companies expecting to purchase planes many years hence may use this distant forward market to purchase the foreign currency they need to pay the manufacturer so that they know with certainty how much home currency they have to find when the planes are delivered.

The table in Exhibit 21.1 displays standard periods of time for forward rates. These are instantly available and are frequently traded. However forward rates are not confined to these particular days in the future. It is possible to obtain rates for any day in the future, say, 74 or 36 days hence. But this would require a specific quotation from a bank.

(The Special Drawing Rights (SDRs) of the International Monetary Fund (IMF) shown at the bottom of the table are artificial currencies made up from baskets of other currencies.)



## Currency rates

Feb 19	Currency	DOLLAR		EURO		POUND	
		Closing mid	Day's change	Closing mid	Day's change	Closing mid	Day's change
<b>Argentina</b>	(Peso)	2.9400	-0.0025	3.7271	-0.0471	5.5551	-0.0499
<b>Australia</b>	(A\$)	1.2677	+0.0092	1.6071	-0.0071	2.3953	-0.0020
One Month		-	-	0.6004	-0.0074	2.3981	-0.0021
One Year		-	-	1.6655	-0.0078	2.4273	-0.0030
<b>Bahrain</b>	(Dinar)	0.3770	-	0.4780	-0.0056	0.7124	-0.0058
<b>Bolivia</b>	(Boliviano)	7.8560	-	9.9591	-0.1174	14.8439	-0.1206
<b>Brazil</b>	(R\$)	2.9465	+0.0083	3.7353	-0.0334	5.5674	-0.0295
<b>Canada</b>	(C\$)	1.3325	+0.0196	1.6893	+0.0053	2.5179	+0.0171
One Month		1.334	+0.0197	1.6898	+0.0055	2.5149	+0.0177
Three Month		1.3368	+0.0198	1.6904	+0.0054	2.5069	+0.0169
One Year		1.3458	+0.0199	1.6924	+0.0053	2.4665	+0.0162
<b>Chile</b>	(Peso)	578.550	+4.7000	733.428	-2.6210	1093.17	+0.0700
<b>Colombia</b>	(Peso)	2693.90	-5.90	3415.06	-47.84	5090.12	-52.59
<b>Costa Rica</b>	(Colon)	423.890	+0.1300	537.365	-6.1710	800.940	-6.2590
<b>Czech Rep.</b>	(Koruna)	25.8046	+0.2871	32.7125	-0.0175	48.7578	+0.1509
One Month		25.8236	+0.2851	32.7102	-0.0186	48.6784	+0.1537
One Year		26.0626	+0.2841	32.7756	-0.0268	47.7649	+0.1250
<b>Denmark</b>	(DKr)	5.8780	+0.0686	7.4516	+0.0001	11.1065	+0.0403
One Month		5.8834	+0.0684	7.4523	+0.0001	11.0904	+0.0415
Three Month		5.8936	+0.0686	7.4529	-0.0003	11.0524	+0.0384
One Year		5.9299	+0.0700	7.4573	+0.0007	10.8678	+0.0382
<b>Egypt</b>	(Egypt £)	6.1801	-	7.8346	-0.0923	11.6773	-0.0949
<b>Estonia</b>	(Kroon)	12.3424	+0.1438	15.6465	-	23.3210	+0.0845
<b>Hong Kong</b>	(HK\$)	7.7737	+0.0025	9.8547	-0.1130	14.6884	-0.1146
One Month		7.7676	+0.0031	9.8390	-0.1115	14.6422	-0.1108
Three Month		7.7547	+0.0028	9.8064	-0.1123	14.5426	-0.1146
One Year		7.7074	+0.0069	9.6927	-0.1059	14.1254	-0.1055
<b>Hungary</b>	(Forint)	206.054	+1.6140	261.215	-1.0100	389.340	-0.0880
One Month		207.974	+1.5040	263.4363	-1.1649	392.03	-0.2680
One Year		228.859	+2.4840	287.8072	-0.2490	419.431	+1.0780
<b>India</b>	(Rs)	45.2400	-0.0350	57.3508	-0.7212	85.4810	-0.7611
One Month		45.24	-0.0175	57.3045	-0.6951	85.279	-0.7132
One Year		45.4225	+0.0100	57.1221	-0.6641	83.2458	-0.6788
<b>Indonesia</b>	(Rupiah)	8432.50	+30.50	10689.90	-86.90	15933.20	-71.40
One Month		-	-	10681.26	-86.30	15895.55	-68.85
One Year		-	-	10604.48	-86.83	15454.23	-73.14
<b>Iran</b>	(Rial)	8365.00	-	10604.30	-125.10	15805.70	-128.40
<b>Israel</b>	(Shk)	4.4480	+0.0120	5.6387	-0.0512	8.4045	-0.0454
<b>Japan</b>	(Y)	107.300	+1.0300	136.024	-0.2830	202.743	+0.3150
One Month		107.205	+1.0350	135.7951	-0.2665	202.088	+0.3600
Three Month		107	+1.0250	135.3084	-0.2882	200.658	+0.2850
One Year		105.875	+0.9950	133.1455	-0.3114	194.038	+0.2150
<b>Kenya</b>	(Shilling)	76.4000	-	96.8523	-1.1422	144.358	-1.1730
<b>Kuwait</b>	(Dinar)	0.2947	+0.0001	0.3736	-0.0043	0.5568	-0.0044
One Month		0.2949	+0.0001	0.3735	-0.0043	0.5559	-0.0043
One Year		0.2972	+0.0001	0.3737	-0.0044	0.5446	-0.0046
<b>Malaysia</b>	(M\$)	3.8000	-	4.8173	-0.0568	7.1801	-0.0584
<b>Mexico</b>	(New Peso)	10.9605	+0.0515	13.8947	-0.0977	20.7098	-0.0702
One Month		11.0002	+0.0494	13.9338	-0.1002	20.7358	-0.0714
Three Month		11.089	+0.0570	14.0228	-0.0928	20.7953	-0.0638
One Year		11.5255	+0.0545	14.4941	-0.1024	21.1227	-0.0763
<b>New Zealand</b>	(NZ\$)	1.4296	+0.0132	1.8123	-0.0045	2.7012	+0.0031
One Month		-	-	1.8171	-0.0049	2.7042	+0.0029
One Year		-	-	1.8780	-0.0045	2.7368	+0.0028
<b>Nigeria</b>	(Naira)	136.600	-	173.168	-2.0420	258.106	-2.0970
<b>Norway</b>	(Nkr)	6.9684	+0.0951	8.8338	+0.0177	13.1667	+0.0740
One Month		6.9735	+0.0947	8.8331	+0.0176	13.1452	+0.0749
Three Month		6.9811	+0.0949	8.8280	+0.0170	13.0917	+0.0713
One Year		7.0051	+0.0940	8.8094	+0.0153	12.8383	+0.0662
<b>Pakistan</b>	(Rupee)	57.3100	-0.0300	72.6519	-0.8953	108.287	-0.9370
<b>Peru</b>	(New Sol)	3.4720	-0.0026	4.4014	-0.0554	6.5602	-0.0585
<b>Philippines</b>	(Peso)	56.2250	+0.1150	71.2764	-0.6931	106.237	-0.6440
One Month		56.599	+0.1405	71.6927	-0.6616	106.691	-0.5840
Three Month		57.2875	+0.1205	72.4441	-0.7020	107.432	-0.6580
One Year		60.4755	+0.1270	76.0524	-0.7395	110.833	-0.6940
<b>Poland</b>	(Zloty)	3.8563	+0.0453	4.8886	+0.0005	7.2864	+0.0272
One Month		3.8693	+0.0446	4.9011	-0.0003	7.2937	+0.0268
One Year		4.0193	+0.0447	5.0545	-0.0030	7.3661	+0.0211

Feb 19	Currency	DOLLAR		EURO		POUND	
		Closing mid	Day's change	Closing mid	Day's change	Closing mid	Day's change
<b>Romania</b>	(Leu)	31912.10	+313.50	40455.00	-75.00	60298.00	+107.30
<b>Russia</b>	(Rouble)	28.4950	+0.0101	36.1231	-0.4131	53.8413	-0.4182
<b>Saudi Arabia</b>	(SR)	3.7502	-	4.7542	-0.0560	7.0860	-0.0576
One Month		3.7508	-	4.7511	-0.0557	7.0705	-0.0563
One Year		3.7623	+0.0001	4.7314	-0.0559	6.8952	-0.0576
<b>Singapore</b>	(S\$)	1.6846	+0.0078	2.1356	-0.0152	3.1831	-0.0111
One Month		1.684	+0.0078	2.1330	-0.0151	3.1744	-0.0105
One Year		1.6771	+0.0083	2.1090	-0.0145	3.0736	-0.0105
<b>Slovakia</b>	(Koruna)	31.9350	+0.4299	40.4840	+0.0740	60.3412	+0.3287
One Month		32.054	+0.4244	40.6021	+0.0673	60.423	+0.3247
One Year		33.183	+0.4394	41.7300	+0.0647	60.8145	+0.3026
<b>Slovenia</b>	(Tolar)	187.285	+2.0650	237.421	-0.1510	353.875	+1.0590
<b>South Africa</b>	(R)	6.6327	+0.0539	8.4084	-0.0298	12.5326	+0.0011
One Month		6.6744	+0.0504	8.4544	-0.0345	12.5816	-0.0043
Three Month		6.7602	+0.0586	8.5488	-0.0259	12.6776	+0.0066
One Year		7.1427	+0.0651	8.9825	-0.0234	13.0906	+0.0111
<b>South Korea</b>	(Won)	1164.50	+12.35	1476.24	-1.57	2200.32	+5.65
One Month		1166.65	+13.05	1477.77	-0.62	2199.17	+7.26
Three Month		1170.35	+12.85	1479.99	-1.05	2194.77	+6.19
One Year		1187.45	+14.55	1493.30	+0.82	2176.24	+8.66
<b>Sweden</b>	(SKr)	7.2466	+0.0884	9.1865	+0.0050	13.6924	+0.0570
One Month		7.2553	+0.0880	9.1901	+0.0048	13.6763	+0.0577
Three Month		7.2722	+0.0886	9.1962	+0.0047	13.6376	+0.0548
One Year		7.3346	+0.0880	9.2238	+0.0027	13.4421	+0.0499
<b>Switzerland</b>	(SFr)	1.2440	+0.0152	1.5771	+0.0010	2.3506	+0.0099
One Month		1.2432	+0.0153	1.5747	+0.0010	2.3436	+0.0105
Three Month		1.2414	+0.0152	1.5699	+0.0009	2.3282	+0.0096
One Year		1.2329	+0.0152	1.5504	+0.0008	2.2595	+0.0091
<b>Taiwan</b>	(T\$)	33.0700	+0.0250	41.9229	-0.4623	62.4858	-0.4600
One Month		33.03	+0.0750	41.8384	-0.3950	62.2627	-0.3539
One Year		32.415	+0.0750	40.7642	-0.3876	59.407	-0.3589
<b>Thailand</b>	(Bt)	39.1800	+0.1700	49.6685	-0.3677	74.0306	-0.2777
One Month		39.195	+0.1750	49.6474	-0.3586	73.884	-0.2566
One Year		39.275	+0.1700	49.3912	-0.3689	71.9793	-0.2888
<b>Tunisia</b>	(Dinar)	1.2139	+0.0119	1.5389	-0.0028	2.2937	+0.0041
<b>Turkey</b>	(Lira)	1331000	+9500	1687309	-7713	2514925	-2335
<b>UAE</b>	(Dirham)	3.6730	-	4.6563	-0.0550	6.9401	-0.0565
One Month		3.6732	-	4.6527	-0.0547	6.924	-0.0553
One Year		3.6755	-	4.6222	-0.0548	6.7361	-0.0565
<b>UK (0.5292)*</b>	(£)	1.8895	-0.0153	0.6709	-0.0025	-	-
One Month		1.885	-0.0150	0.6720	-0.0025	-	-
Three Month		1.8753	-0.0154	0.6743	-0.0024	-	-
One Year		1.8326	-0.0153	0.6862	-0.0024	-	-
<b>Uruguay</b>	(Peso)	29.4150	-	37.2894	-0.4398	55.5797	-0.4514
<b>USA</b>	(\$)	-	-	1.2677	-0.0150	1.8895	-0.0153
One Month		-	-	1.2667	-0.0149	1.885	-0.0150
Three Month		-	-	1.2646	-0.0149	1.8753	-0.0154
One Year		-	-	1.2576	-0.0149	1.8326	-0.0153
<b>Venezuela †</b>	(Bolivar)	3157.36	+54.66	4002.58	+22.90	5965.82	+55.64
<b>Vietnam</b>	(Dong)	15723.00	-3.00	19932.00	-239.00	29708.60	-247.10
<b>Euro (0.7888)*</b>	(Euro)	1.2677	-0.0150	-	-	1.4905	+0.0054
One Month		1.2667	-0.0149	-	-	1.4882	+0.0055
Three Month		1.2646	-0.0149	-	-	1.4829	+0.0051
One Year		1.2575	-0.0150	-	-	1.4573	+0.0050
<b>SDR</b>	-	0.66720	-	0.84585	-0.0044	1.260800	-

Rates are derived from WM/Reuters at 4pm (London time). \*The closing mid-point rates for the Euro and £ against the \$ are shown in brackets. The other figures in the dollar column of both the Euro and Sterling rows are in the reciprocal form in line with market convention. †Official rate set by Venezuelan government is 1917.60 mid per USD; the WM/Reuters rate is for the valuation of capital assets. Some values are rounded by the FT. The exchange rates printed in this table are also available on the internet at <http://www.FT.com>.

Euro Locking Rates: Austrian Schilling 13.7603, Belgium/Luxembourg Franc 40.3399, Finnish Markka 5.94573, French Franc 6.55957, German Mark 1.95583, Greek Drachma 340.75, Irish Punt 0.0787564, Italian Lira 1936.27, Netherlands Guilder 2.20371, Portugese Escudo 200.482, Spanish Peseta 166.386.

## EXHIBIT 21.1 Currency rates table in the FT

Source: Financial Times, 20 February 2004

## Covering in the forward market

---

Suppose that on 19 February 2004 a UK exporter sells goods to a customer in Norway invoiced at Nkr5,000,000. Payment is due three months later. With the spot rate of exchange at Nkr13.1667/£ (*see* Exhibit 21.1) the exporter, in deciding to sell the goods, has in mind a sales price of:

$$\frac{5,000,000}{13.1667} = \text{£}379,746$$

The UK firm bases its decision on the profitability of the deal on this amount expressed in pounds.

However the rate of exchange may vary between February and May: the size and direction of the move is uncertain. If sterling strengthens against the Norwegian Krone the UK exporter makes a currency loss by waiting three months and exchanging the dollars received into sterling at spot rates in May. If, say, one pound is worth Nkr15 in May the exporter will receive only £333,333:

$$\frac{5,000,000}{15} = \text{£}333,333$$

The loss due to currency movement is:

$$\begin{array}{r} \text{£}379,746 \\ \text{£}333,333 \\ \hline \text{£}46,413 \end{array}$$

If sterling weakens to, say, Nkr11/£ a currency gain is made. The pounds received in May if dollars are exchanged at the spot rate are:

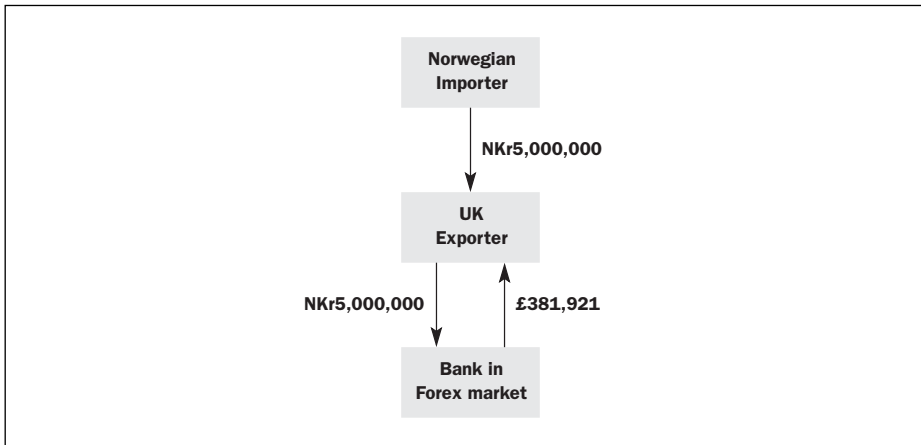
$$\frac{5,000,000}{11} = \text{£}454,545$$

The currency gain is:

$$\begin{array}{r} \text{£}454,545 \\ \text{£}379,746 \\ \hline \text{£}74,799 \end{array}$$

Rather than run the risk of a possible loss on the currency side of the deal the exporter may decide to cover in the forward market at the time of the export (19 February). Under this arrangement the exporter promises to sell Nkr5,000,000 against sterling in three months (the agreement is made on 19 February for delivery of currency in May). The 3-month forward rate available<sup>4</sup> on 19 February 2004 is Nkr13.0917/£ (*see* Exhibit 21.1). This forward contract means that the exporter is assured of the receipt of £381,921 in May regardless of the way in which spot exchange rate change over the three months:

**FIGURE 21.3**  
**Forward market transaction**



$$\frac{5,000,000}{13.0917} = \text{£}381,921$$

In May the transactions shown in Figure 21.3 take place.

From the outset the exporter knew the amount to be received in May (assuming away credit risk). It might, with hindsight, have been better not to use the forward market but to exchange the dollars at a spot rate of, say, Nkr11/£. This would have resulted in a larger income for the firm. But there was uncertainty about the spot rate in May when the export took place in February. If the spot rate in May had turned out to be Nkr15/£ the exporter would have made much less. Covering in the forward market is a form of insurance, which leads to greater certainty – and certainty has a value.

## Types of foreign-exchange risk

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There are three types of risk for firms that operate in an international market-place:

- transaction risk
- translation risk
- economic risk.

### Transaction risk

Transaction risk is the risk that transactions already entered into, or for which the firm is likely to have a commitment in a foreign currency, will have a variable value in the home currency because of exchange-rate movements.

This type of risk is primarily associated with imports or exports. If a company exports goods on credit then it carries a figure for debtors in its accounts. The amount it will receive in home-currency terms is subject to uncertainty if the customer pays in a foreign currency.

Likewise a company that imports on credit will have a creditor figure in its accounts. The amount that is finally paid in terms of the home currency depends on forex movements, if the invoice is in a foreign currency. Transaction risk also arises when firms invest abroad, say, opening a new office or manufacturing

## Balance sheets left reeling by Real

Jonathan Wheatley

It has been a bizarre year for Brazilian companies. Whether or not they supported the campaign of president-elect Luiz Inácio Lula da Silva – and many of them did – senior executives have felt the impact of his election even though he does not take office until January 1.

Concern among investors that a left-wing government under Lula – as he is universally known – might presage a default on Brazil's debts has caused the currency to shed more than 40 per cent of its value to the end of September, wreaking havoc on companies' balance sheets.

For most big companies, many of which borrow in dollars but make their income in Reals, the devaluation has been little short of calamitous.

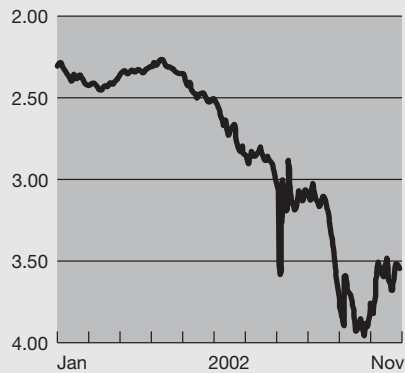
'They are extremely vulnerable,' says Fernando Excel of *Econômica*. 'Even if only a small part of a company's debt is unhedged, a devaluation on this scale causes an enormous disaster.'

Many Brazilian companies began hedging their dollar debts when the Real began to slide during the second quarter, as opinion polls showed Lula leading the presidential campaign. But few imagined that the Real would fall so far.

As the situation worsened and international banks began reducing their exposure to Brazil, the cost of hedging

### Brazilian real

Against the US dollar (R\$ per US\$)



Source: Thomson Datastream; WM/Reuters

became increasingly prohibitive. Many concluded – incorrectly, as it turned out – that hedging was not worth the expense.

Usiminas, one of Brazil's biggest steel producers, saw the value of its sales rise by 37 per cent in the third quarter over last year, to R\$1.68bn. Nevertheless, it recorded a net loss of R\$1.68m, because both the operating company and especially, Cosipa, a subsidiary, were not fully hedged.

'Cosipa is one of the most leveraged companies in the industry. Hedging just became too expensive,' says Katia Brullo of Corretora Unibanco, a Sao Paulo brokerage.

## EXHIBIT 21.2 Balance sheets left reeling by Real

Source: *Financial Times*, 26 November 2002

plant. If the costs of construction are paid for over a period the firm may be exchanging the home currency for the foreign currency to make the payments. The amounts of the home currency required are uncertain if the exchange rate is subject to rate shifts. Also the cash inflows back to the parent are subject to exchange-rate risk.

In addition, when companies borrow in a foreign currency, committing themselves to regular interest and principal payments in that currency, they are exposed to forex risk. This is a problem that beset a number of Brazilian companies in 2002. They had committed themselves to paying off borrowings in a hard currency (e.g. US dollars, sterling). This became a serious problem when the debt rose by 40 percent simply because of the decline in their currency against the hard currency – see Exhibit 21.2.

## Translation risk

Translation risk arises because financial data denominated in one currency are then expressed in terms of another currency. Between two accounting dates the figures can be affected by exchange-rate movements, greatly distorting comparability. The financial statements of overseas business units are usually translated into the home currency so that they might be consolidated with the group's financial statements. Income, expenses, assets and liabilities have to be re-expressed in terms of the home currency. Note that this is purely a paper-based exercise; it is translation and not the conversion of real money from one currency to another. If exchange rates were stable, comparing subsidiary performance and asset position would be straightforward. However, if exchange rates move significantly the results can be severely distorted. For example, Courts, the furniture and electrical retailer, which has 60 percent of its turnover overseas found that even though overseas sales rose 8 percent in local currency terms, when the figures were translated into sterling, a fall of 4 percent was reported. This was mainly because sterling rose against the dollar. See Exhibit 21.3.

**This is purely a paper-based exercise; it is translation and not the conversion of real money from one currency to another.**

There are two elements to translation risk.

- *The balance sheet effect* Assets and liabilities denominated in a foreign currency can fluctuate in value in home-currency terms with forex-market changes. For example, if a UK company acquires A\$1,000,000 of assets in Australia when the rate of exchange is A\$2.2/£ this can go into the UK group's accounts at a value of £454,545. If, over the course of the next year, the Australian dollar falls against sterling to A\$2.7/£, when the consolidated accounts are drawn up and the asset is translated at the current exchange rate at the end of the year it is valued at only £370,370 (1,000,000/2.7) a 'loss' of £84,175. And yet the asset has not changed in value in A\$ terms one jot. These 'losses' are normally dealt with through balance sheet reserves.

## Courts moves to limit foreign exchange damage

By Sophy Buckley

Courts yesterday issued a disappointing trading update for the Christmas and early winter sale period and flagged a full strategic review.

The immediate focus was on news that the weak dollar would cut profits by £4m this year and changes to financing would cost £5m and lift borrowing costs by £1m.

This prompted analysts to cut their profit forecasts for the furniture and

electricals group. Seymour Pierce reduced its numbers from £24m to £14m, and Evolution Beeson Gregory moved from £30m to £22m.

For the six weeks to January 11, the weak dollar turned an 8 per cent rise in overseas sales at constant exchange rates into a 4 per cent fall. A 4 per cent rise in like-for-like sales became an 8 per cent fall when translated into sterling.

### EXHIBIT 21.3 Courts moves to limit foreign exchange damage

Source: *Financial Times* 20 January 2004

- *The profit and loss account effect* Currency changes can have an adverse impact on the group's profits because of the translation of foreign subsidiaries' profits. This often occurs even though the subsidiaries' managers are performing well and increasing profit in terms of the currency in which they operate, as the case of Courts (*see* Exhibit 21.3) indicates.

### Economic risk

A company's economic value may decline as a result of forex movements causing a loss in competitive strength. The worth of a company is the discounted cash flows payable to the owners. It is possible that a shift in exchange rates can reduce the cash flows of foreign subsidiaries and home-based production far into the future (and not just affect the near future cash flows as in transaction exposure). There are two ways in which competitive position can be undermined by forex changes:

- *Directly* If your firm's home currency strengthens then foreign competitors are able to gain sales and profits at your expense because your products are more expensive (or you have reduced margins) in the eyes of customers both abroad and at home.
- *Indirectly* Even if your home currency does not move adversely *vis-à-vis* your customer's currency you can lose competitive position. For example suppose a South African firm is selling into Hong Kong and its main competitor is a New Zealand firm. If the New Zealand dollar weakens against the Hong Kong dollar the South African firm has lost some competitive position.

Another indirect effect occurs even for firms that are entirely domestically oriented. For example, the cafés and shops surrounding a large export-oriented manufacturing plant may be severely affected by the closure of the factory caused by an adverse forex movement.

## Transaction risk strategies

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This section illustrates a number of strategies available to deal with transaction risk by focussing on the alternatives open to an exporter selling goods on credit.

Suppose a UK company exports £1m of goods to a Canadian firm when the spot rate of exchange is C\$2.20/£. The Canadian firm is given three months to pay, and naturally the spot rate in three months is unknown at the time of the shipment of goods. What can the firm do?

### Invoice the customer in the home currency

One easy way to bypass exchange-rate risk is to insist that all foreign customers pay in your currency and your firm pays for all imports in your home currency. In the case of this example the Canadian importer will be required to send £1m in three months.

However the exchange-rate risk has not gone away, it has just been passed on to the customer. This policy has an obvious drawback: your customer may dislike it, the marketability of your products is reduced and your customers look elsewhere for supplies. If you are a monopoly supplier you might get away with the policy but for most firms this is a non-starter.

### Do nothing

Under this policy the UK firm invoices the Canadian firm for C\$2.2m, waits three months and then exchanges into sterling at whatever spot rate is available then. Perhaps an exchange-rate gain will be made, perhaps a loss will be made. Many firms adopt this policy and take a 'win some, lose some' attitude. Given the fees and other transaction costs of some hedging strategies this can make sense.

There are two considerations for managers here. The first is their degree of risk aversion to higher cash flow variability, coupled with the sensitivity of shareholders to reported fluctuations of earnings due to foreign exchange gains and losses. The second, which is related to the first point, is the size of the transaction. If £1m is a large proportion of annual turnover, and greater than profit, then the managers may be more worried about forex risk. If, however, £1m is a small fraction of turnover and profit, and the firm has numerous forex transactions, it may choose to save on hedging costs.

There is an argument that it would be acceptable to do nothing if it was anticipated that the Canadian dollar will appreciate over the three months. Be



**Predicting exchange rates is a dangerous game.**

careful. Predicting exchange rates is a dangerous game and more than one 'expert' has made serious errors of judgment.

## Netting

Multinational companies often have subsidiaries in different countries selling to other members of the group. Netting is where the subsidiaries settle intra-organisational currency debts for the *net* amount owed in a currency rather than the *gross* amount. For example, if a UK parent owned a subsidiary in Canada and sold C\$2.2m of goods to the subsidiary on credit while the Canadian subsidiary is owed C\$1.5m by the UK company, instead of transferring a total of C\$3.7m the intra-group transfer is the net amount of C\$700,000 (*see* Figure 21.4).

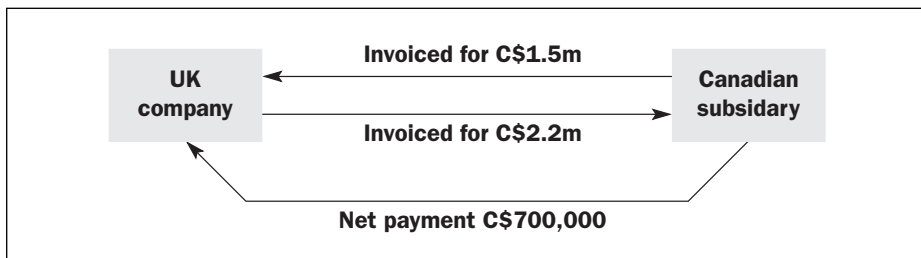
The reduction in the size of the currency flows by offsetting inflows and outflows in the same currency diminishes the net exposure that may have to be hedged. It also reduces the transaction costs of currency transfers in terms of fees and commissions.

This type of netting, involving two companies within a group, is referred to as bilateral netting, and is simple to operate without the intervention of a central treasury. However for organizations with a matrix of currency liabilities between numerous subsidiaries in different parts of the world, multilateral netting is required. A central treasury is usually needed so that there is knowledge at any point in time of the overall exposure of the firm and its component parts. Subsidiaries will be required to inform the group treasury about their overseas dealings, which can then co-ordinate payments after netting out intra-company debts. The savings on transfer costs levied by banks can be considerable.

## Matching

Netting only applies to transfers within a group of companies. Matching can be used for both intra-group transactions and those involving third parties. The company matches the inflows and outflows in different currencies caused by

**FIGURE 21.4**  
**Netting**



**FIGURE 21.5**  
**Matching**



trade, etc., so that it is only necessary to deal on the forex markets for the unmatched portion of the total transactions.

So if, say, the Canadian importer is not a group company and the UK firm also imported a raw material from another Canadian company to the value of C\$2m it is necessary only to hedge the balance of C\$200,000 (*see* Figure 21.5).

Naturally, to net and match properly, the timing of the expected receipts and payments would have to be the same.

### Leading and lagging

Leading is the bringing forward from the original due date the payment of a debt. Lagging is the postponement of a payment beyond the due date. This speeding up or delaying of payments is particularly useful if you are convinced exchange rates will shift significantly between now and the due date.

So, if the UK exporter who invoiced a Canadian company for C\$2.2m on three months' credit expects that the Canadian dollar will fall over the forthcoming three months it may try to obtain payment immediately and then exchange for sterling at the spot rate. Naturally the Canadian firm will need an incentive to pay early and this may be achieved by offering a discount for immediate settlement.

An importer of goods in a currency that is anticipated to fall in value may attempt to delay payment as long as possible. This may be achieved either by agreement or by exceeding credit terms.

### Forward market hedge

Although other forms of exchange-risk management are available, forward cover represents the most frequently employed method of hedging. A contract is agreed to exchange two currencies at a fixed time in the future at a predetermined rate. The risk of forex variation is removed.

So if the three-month forward rate is C\$2.25/£ the UK exporter could lock in the receipt of £977,778 in three months by selling forward C\$2.2m.

$$\frac{\text{C\$2.2m}}{2.25} = \text{£977,778}$$

No foreign exchange-rate risk now exists because the dollars to be received from the importer are matched by the funds to be exchanged for sterling. (There does remain the risk of the importer not paying, at all or on time, and the risk of the counterparty in the forex market not fulfilling its obligations.)

### Money market hedge

Money market hedging involves borrowing in the money markets. For example, the exporter could, at the time of the export, borrow in Canadian dollars on the money markets for a three-month period. The amount borrowed, plus three months' interest, will be designed to be equal to the amount to be received from the importer (C\$2.2m).

**Money market hedging involves borrowing in the money markets.**

If the interest rate charged over three months is 2 percent then the appropriate size of the loan is:

$$\begin{aligned} \text{C\$2.2m} &= \text{C\$?}(1+0.02) \\ \text{C\$?} &= \frac{\text{C\$2.2m}}{1.02} = \text{C\$2,156,863} \end{aligned}$$

Thus the exporter has created a liability (borrowed funds) that matches the asset (debt owed by Canadian firm).

The borrowed dollars are then converted to sterling on the spot market for the exporter to receive £980,392 immediately:

$$\frac{\text{C\$2,156,863}}{2.2} = \text{£980,392}$$

The exporter has removed forex risk because it now holds cash in sterling.

Three months later C\$2.2m is received from the importer and this exactly matches the outstanding debt:

Amount borrowed + interest = debt owed at end of period

$$\text{C\$2,156,863} + \text{C\$2,156,863} \times 0.02 = \text{C\$2.2m}$$

The receipt of £980,392 is £19,608 less than the £1m originally anticipated. However it is received three months earlier and can earn interest.

The steps in the money market hedge are as follows.

1. Invoice customer for C\$2.2m.
2. Borrow C\$2,156,863.
3. Sell C\$2,156,863 at spot to receive pounds now.
4. In three months receive C\$2.2m from customer.
5. Pay lender C\$2.2m.

An importer could also use a money market hedge. So a Swiss company importing Japanese cars for payment in yen in three months could borrow in Swiss francs now and convert the funds at the spot rate into yen. This money is deposited to earn interest, with the result that after three months the principal plus interest equals the invoice amount.

## Futures

A foreign currency futures contract is an agreement to exchange a specific amount of a currency for another at a fixed future date for a predetermined price. Futures are similar to forwards in many ways. They are, however, standardized contracts traded on regulated exchanges. Forwards can be tailor-made in a wide range of currencies as to quantity of currency and delivery date, whereas futures are only available in a limited range of currencies and for a few specific forward time periods.

The Chicago Mercantile Exchange (CME) and the FINEX market (New York Board of Trade) operate futures markets in currencies including: US\$/£, US\$/¥, US\$/SFr (Swiss franc), US\$/€. A single futures contract is for a fixed amount of currency. For example, a sterling contract on CME is for £62,500. It is not possible to buy or sell a smaller amount than this, nor to transact in quantities other than whole-number multiples of this. On the CME to buy a sterling futures contract is to make a commitment to deliver a quantity of US dollars and receive in return £62,500. On 19 February 2004 the CME quoted contracts for delivery in late March and June (and for no months in between)<sup>5</sup> – see last two lines on Exhibit 21.4. For example, the June contract was priced at 1.8766 (the ‘open’ column indicates the rate at the start of trading on 19 February). This means that if you *buy* one contract you are committed to deliver US\$1.8766 for every pound of the £62,500 you will receive in late June, that is US\$117,287.50. If you *sold* one contract at 1.8766 you would deliver £62,500 and receive US\$117,287.50.

## Currency futures

Feb 19		Open	Latest	Change	High	Low	Est. vol.	Open int.
€-Sterling*	Mar	0.6730	0.6713	-0.0020	0.6726	0.6714	513	11,894
€-Dollar*	Mar	1.2710	1.2690	+0.0010	-	0.0000	302	734
€-Yen*	Mar	135.15	135.99	+0.72	135.48	135.48	859	10,652
\$-Can \$ †	Mar	0.7550	0.7522	-0.0016	0.7557	0.7483	7,658	58,873
\$-Euro € †	Mar	1.2690	1.2692	-0.0004	1.2728	1.2639	14,112	144,529
\$-Euro € †	Jun	1.2674	1.2662	-0.0004	1.2695	1.2611	195	1,980
\$-Sw Franc †	Mar	0.8061	0.8056	-0.0012	0.8085	0.8026	5,116	46,593
\$-Sw Franc †	Jun	0.8090	0.8074	-0.0012	0.8091	0.8045	27	433
\$-Yen †	Mar	0.9377	0.9330	-0.0044	0.9412	0.9313	11,921	146,746
\$-Yen †	Jun	0.9421	0.9357	-0.0044	0.9426	0.9343	106	9,110
\$-Sterling †	Mar	1.8860	1.8911	+0.0077	1.8944	1.8831	3,835	69,250
\$-Sterling †	Jun	1.8708	1.8766	+0.0076	1.8801	1.8695	17	553

Sources: \*FINEX; Sterling €100,000, Dollar: €200,000 and Yen: €100,000. †CME: Canadian \$: C\$100,000, Euro: €125,000; Swiss Franc: SFr125,000; Yen: ¥12.5m (\$ per ¥100); Sterling: £62,500. CME volume, high & low for pit & electronic trading at settlement. Contracts shown are based on the volumes traded in 2001.

### EXHIBIT 21.4 Currency futures on the Chicago Mercantile Exchange and FINEX

Source: *Financial Times* 20 February 2004

A firm hedging with currency futures will usually attempt to have a futures position which has an equal and opposite profit profile to the underlying transaction. Frequently the futures position will be closed before delivery is due, to give a cash profit or loss to offset the spot market profit or loss (for more details on futures see Chapter 20) – although physical delivery of the currency is possible. For example, if a US firm exports £62,500 worth of goods to a UK firm in February on four months' credit for payment in late June and the current spot exchange rate is US\$1.8895/£ there is a foreign exchange risk. If the June future is trading at a price of US\$1.8766 per £ the exporter's position could be hedged by selling one sterling futures contract on CME.

If in June sterling falls against the dollar to US\$1.60/£ the calculation is:

Value of £62,500 received from customer when converted to dollars at spot in June ( $£62,500 \times 1.60$ )	US\$100,000
Amount if exchange rate was constant at US\$1.8895/£	US\$118,094
Forex loss	US\$18,094

However an offsetting gain is made on the futures contract:

Sold at US\$1.8766/£ ( $£62,500 \times 1.8766$ )	US\$117,288
Bought in June to close position at US\$1.60/£ ( $£62,500 \times 1.60$ )	US\$100,000
Futures gain	US\$17,288

Alternatively the exporter could simply deliver the £62,500 received from the importer to CME in return for US\$117,288. (Note that the futures contract rate of exchange in June converges with the spot rate at the date of expiry, in late June, i.e. US\$1.60/£.)

In the above example a perfect hedge was not achieved because the gain on the futures contract did not exactly offset the loss on the underlying position (i.e. the pounds to be received from the UK customer). Perfect hedging is frequently unobtainable with futures because of their standardized nature. Perhaps the amount needed to be hedged is not equal to a whole number of contracts, for example £100,000, or the underlying transaction takes place in November (when no future is available).

**Perfect hedging is frequently unobtainable with futures because of their standardized nature.**

Futures did not prove very popular in the UK when traded on LIFFE. This was largely due to the existence of more flexible and convenient forms of currency hedges such as forwards and currency options.

## Currency options

The final possible course of action to reduce forex transaction risk to be discussed in this chapter is to make use of the currency option market.

A currency option is a contract giving the buyer (that is, the holder) the right, but not the obligation, to buy or sell a specific amount of currency at a specific exchange rate (the strike price), on a specified future date.<sup>6</sup>

A call option gives the right to buy a particular currency.

A put option gives the right to sell a particular currency.

The option writer (usually a bank) guarantees, if the option buyer chooses to exercise the right, to exchange the currency at the predetermined rate. Because the writer is accepting risk the buyer must pay a premium to the writer – normally within two business days of the option purchase. (For more details on options see Chapter 20.)

Currency options premiums are shown for the currency rates between the US\$ and the euro, the US\$ and the Yen and the US\$ and the UK pound in the *Financial Times* – see Exhibit 21.5. This data is taken from the trading system of the Chicago Mercantile Exchange (CME). For the US\$/UK£ call options the purchaser has the right but not the obligation to purchase pounds for dollars. The call holder has a number of possible rates of exchange open to himself/herself. The ones shown in the FT (\$1.8700/£ to \$1.9000/£) represent just a few of the possibilities. The premiums payable, shown in the body of the table, are quoted as US cents per pound. One contract is for £62,500, and you are only

able to purchase whole numbers of contracts on the exchange. If you purchased a 1870 call option for expiry in April you would pay a premium of 2.64 US cents per UK pound (the total premium payable would be  $\$0.0264 \times 62,500 = \$1,650$ ) giving you the right to buy pounds with dollars in April at a rate of  $\$1.8700/\pounds$ . Note that a less favorable exchange rate, e.g. 1880 commands a lower premium, only 2.16 cents per pound under the contract.

The purchase of a put option gives you the right but not the obligation to *sell* pounds and receive dollars. Again the quantity of a contract is for  $\pounds 62,500$ .

## Currency options

### ■ US \$/€ OPTIONS (CME)

Strike price	CALLS			PUTS		
	Feb 19	Mar	Apr	May	Mar	Apr
12500	2.44	3.03	–	0.46	1.35	–
12600	1.72	2.46	–	0.82	1.80	–
12700	1.15	1.95	–	1.32	2.21	–
12800	0.74	1.48	2.00	1.80	2.86	–

Previous day's data: volume, 2,359; calls, 5,250 puts, 7,609; open interest, 80,162. Source: Reuters/CME.

### ■ US \$/YEN OPTIONS (CME)

Strike price	CALLS			PUTS		
	Feb 19	Mar	Apr	May	Mar	Apr
9200	1.50	2.38	2.58	0.19	0.46	0.58
9300	0.87	1.65	–	0.47	0.78	1.00
9400	0.31	1.02	–	0.96	1.09	1.40
9500	0.12	0.61	–	1.43	1.90	–

Previous day's data: volume, 1,742; calls, 1,033 puts, 2,775; open interest, 43,064. Source: Reuters/CME.

### ■ US \$/UK£ OPTIONS (CME)

Strike price	CALLS			PUTS		
	Feb 19	Mar	Apr	May	Mar	Apr
1870	2.48	2.64	–	0.71	2.74	–
1880	2.16	2.26	–	1.14	–	–
1890	1.44	1.90	–	1.56	–	–
1900	1.24	–	–	2.74	–	–

Previous day's data: volume, 1,007; calls, 278 puts, 1,285; open interest, 11,826. Source: Reuters/CME

## EXHIBIT 21.5 Currency options displayed in the *Financial Times*

Source: *Financial Times* 20 February 2004

The \$/€ call and put premiums are quoted as US cents per euro under the contract. One contract is for €125,000. The yen contracts are different in that the quoted premiums are US cents per 100 yen. Each contract is for 12.5m yen.

The CME quotes option prices for many more exchange rates than those shown in the FT – see [www.cme.com](http://www.cme.com).

The crucial advantage an option has over a forward is the absence of an obligation to buy or sell. It is the option buyer's decision whether to exercise the option and insist on exchange at the strike rate or to let the option lapse.

With a forward there is a hedge against both a favorable and an unfavorable movement in forex rates. This means that if the exchange rate happens to move in your favor after you are committed to a forward contract you cannot take any advantage of that movement. We saw above that if the forward rate was C\$2.25/£ the exporter will receive £977,778 in three months. If the spot exchange rate had moved to, say, C\$1.9/£ over the three months the exporter would have liked to abandon the agreement to sell the dollars at C\$2.25/£, but is unable to do so because of the legal commitment. By abandoning the deal and exchanging at spot when the Canadian firm pays the exporter will receive an income of:

$$\frac{\text{C\$2.2m}}{1.9} = \text{£1,157,895}$$

This is an extra £180,117.

An option permits both:

- hedging against unfavorable currency movement; and
- profit from favorable currency movement.

### Worked example 21.1 CURRENCY OPTION CONTRACT

Now, imagine that the treasurer of the UK firm hedges by buying a three-month sterling call option giving the right but not the obligation to deliver Canadian dollars in exchange for pounds with a strike price of C\$2.25/£ when the goods are delivered to the Canadian firm in February.

To induce a bank to make the commitment to exchange at the option holder's behest a premium will need to be paid up front. Assume this is 2% of the amount covered, that is a non-refundable  $0.02 \times \text{C\$2,200,000} = \text{C\$44,000}$  is payable two business days after the option deal is struck.

*Three months later*

The dollars are delivered by the importer on the due date. The treasurer now has to decide whether or not to exercise the right to exchange those dollars for sterling at C\$2.25/£. Let us consider two scenarios:



## Scenario 1

The dollar has strengthened against the pound to C\$1.9/£. If the treasurer exercises the right to exchange at C\$2.25/£ the UK firm will receive:

$$\frac{\text{C}\$2,200,000}{2.25} = \text{£}977,778$$

If the treasurer takes the alternative and lets the option lapse – ‘abandons it’ – and exchanges the dollars in the spot market, the amount received will be:

$$\frac{\text{C}\$2,200,000}{1.9} = \text{£}1,157,895$$

Clearly in this case the best course of action would be not to exercise the option, but to exchange at spot rate. Note that the benefit of this action is somewhat reduced by the earlier payment of C\$44,000 for the premium.

## Scenario 2

Now assume that the dollar has weakened against sterling to C\$2.5/£. If the treasurer contacts the bank (the option writer) to confirm that the exporter wishes to exercise the option the treasurer will arrange delivery of C\$2,200,000 to the bank and will receive £977,778 in return:

$$\frac{\text{C}\$2,200,000}{2.25} = \text{£}977,778$$

The alternative, to abandon the option and sell the C\$2.2m in the spot forex market, is unattractive:

$$\frac{\text{C}\$2,200,000}{2.5} = \text{£}880,000$$

Again, the option premium needs to be deducted to give a more complete picture.

With the option, the worst that could happen is that the exporter receives £977,778, less the premium. However the upside potential is unconstrained.

Option contracts are generally for sums greater than US\$1m on the OTC (over-the-counter) market (direct deals with banks) whereas one contract on CME is, for example, for £62,500. The drawback with exchange-based derivatives is the smaller range of currencies available and the inability to tailor-make a hedging position.

Exhibit 21.6 discusses the attitude of some treasurers and analysts to hedging forex risk.

## To hedge or not to hedge

**There is a range of futures, swaps and currency options from which to choose.**

Simon Kuper

A company can expend blood, sweat and tears on achieving a 15 per cent rise in exports. But when it converts its foreign income into its home currency, it may be in for a nasty shock. If its domestic currency has risen by 15 per cent, all the extra profits will be wiped out.

The phenomenon is called currency risk. Corporate treasurers, the people who manage this risk for their companies, have a much more complicated life now than they did a decade ago, says Mr John Parry, director of Rostron Parry, a consultancy specialising in financial markets and derivatives.

Ten years ago there was little more a treasurer could do to hedge risk than buy a currency forward – that is, to set a price today for which he agreed to buy the currency at a certain time in the future. Now there is a range of futures, swaps and currency options from which to choose.

Perhaps the form of hedging that is growing fastest is the currency option. It gives a company the right to buy or sell a currency at a set price at a certain time in the future. This can be expensive: a 'plain vanilla' option can cost 4 per cent of the amount of pounds the user needs to buy.

But before treasurers even look into ways of hedging risk, they are faced with a big question: should they bother? Some companies never hedge, choosing instead to live with currency risk. They argue that while exchange rates sometimes move against them, they sometimes change in their favour. For instance, if the pound falls, a UK company will see the value of its foreign earnings rise when it converts

them into sterling. To have hedged would have meant to lose these windfall gains.

UK and US companies would have mostly gained from leaving their currency exposure unhedged in recent years, as the pound and dollar have tended to fall. But there was a turnaround in recent months, when the pound's surge hit UK exporters. According to foreign exchange advisers, most have never hedged. Profits have been sliced at many companies.

Critics of hedging currency risk often cite companies which have come a cropper from dabbling in derivatives. Allied Lyons, the UK foods company, lost \$150m after currency options positions went wrong in 1991. Orange County in California, the Belgian government, and the unlucky Nick Leeson of Barings Bank are no advertisements for buying 'derivatives' either. 'Mention the word "derivatives" around a board table and everybody freezes,' says Mr Jeremy Wagener, director-general of the UK's Association of Corporate Treasurers.

The Allied Lyons affair has made UK companies more wary of derivatives than their rivals are in France, the US and Scandinavia, according to bankers. Even a company as large as British Steel proclaims proudly that it never uses currency options. 'We don't go in for anything fancy,' it says. 'We only buy straightforward forwards.'

Companies outside the UK often regard their currency management side as a profit centre, says Ms Lisa Danino, a saleswoman at Bank of America. She adds: 'In sophistication, the UK corporates are quite a way behind.'

Small businesses tend to be those most frightened of hedging. 'They often have no treasurer and no thoughts on the subject at all,' says Mr Wagener. Mr Michele di Stefano, head of forex sales at BZW, says: 'In most cases, treasury operations are understaffed.' Even treasurers who themselves understand complex hedging products have to be able to explain them to their directors, often a tricky task.

Nor can customers always trust banks to give them impartial advice on derivatives. The banks, after all, are trying to sell products. Mr Bill McLuskie, treasurer of Canary Wharf Ltd in the UK, claims: 'I know bankers who say, "Given the quality of some treasurers, it's easy to con them".'

Mr McLuskie and Mr Wagener nonetheless preach the virtues of hedging currency risk. The main thing a

company is buying is certainty, they say. No longer can its cash flow stall and start depending on which way the forex market moves. To hedge is to buy insurance, says Mr Wagener. A risk-averse company should hedge; a company with risk-appetite may well consider not doing so.

Many people regard buying currency derivatives as 'speculation', says Mr McLuskie. In fact, he argues, the opposite is true. *Not* to buy the products is to speculate on the foreign exchange market. And most companies have no special insight into which way a currency will move. Mr Parry says: 'Your job as a producer of goods and services is not to second-guess the foreign exchange markets.'

Mr Parry says: 'The question in the end is what value you put on being able to sleep at night when the markets are moving all over the place.'

### EXHIBIT 21.6 To hedge or not to hedge

Source: *Financial Times* 18 April 1997

## Managing translation risk

The effect of translation risk on the balance sheet can be lessened by matching the currency of assets and liabilities. For example, Graft plc has decided to go ahead with a US\$190m project in the USA. One way of financing this is to borrow £100m and exchange this for dollars at the current exchange rate of US\$1.9/£. Thus at the beginning of the year the additional entries into the consolidated accounts are as shown in Worked Example 21.2.

### Worked example 21.2 TRANSLATION RISK

#### Opening balance sheet

<i>Liabilities</i>		<i>Assets</i>	
Loan	£100m	US assets	£100m

The US\$190m of US assets are translated at US\$1.9/£ so all figures are expressed in the parent company's currency.

Now imagine that over the course of the next year the dollar depreciates against sterling to US\$2.30/£. In the consolidated group accounts there is still a £100m loan but the asset bought with that loan, while still worth US\$190m,<sup>7</sup> is valued at only £82.61m when translated into sterling. In the parent company's currency terms, £17.39m needs to be written off:

#### Year-end balance sheet

<i>Liabilities</i>		<i>Assets</i>	
Loan	£100m	US assets	£100m
	<u>£100m</u>		<u>£82.61m</u>
Forex loss	-£17.39m		

Alternatively Graft plc could finance its dollar assets by obtaining a dollar loan. Thus, when the dollar depreciates, both the asset value and the liability value in translated sterling terms becomes less.

#### Opening balance sheet

<i>Liabilities</i>		<i>Assets</i>	
Loan	£100m	US assets	£100m

If forex rates move to US\$2.30/£:

#### Year-end balance sheet

<i>Liabilities</i>		<i>Assets</i>	
Loan	£82.61m	US assets	£82.61m

There is no currency loss to deal with.

One constraint on the solution set out in Worked Example 21.2 is that some governments insist that a proportion of assets acquired within their countries is financed by the parent firm. Another constraint is that the financial markets in some countries are insufficiently developed to permit large-scale borrowing.

Many economists and corporate managers believe that translation hedging is unnecessary because, on average over a period of time, gains and losses from forex movements will even out to be zero. Exhibit 21.7 considers the reasons for most companies taking no steps to hedge against profit translation risk.

## When a hedge is not a gardener's problem

Richard Adams

As the half-yearly company reporting season has got under way, so too have the protests from UK companies that the strength of sterling is cutting profits.

BOC, the gas producer, estimated that sterling's rapid rise in the last 12 months would cut £46m off its annual profits because of the cost of translating foreign currency earnings into sterling.

But, as one letter writer to the *Financial Times* recently asked, surely UK companies could avoid these problems by hedging their currency exposure, using financial instruments to protect against exchange rate fluctuations?

In fact, exporters use a number of techniques to lower currency risks. An engineering firm exporting machinery to Germany, for example, could price its contracts in sterling and shift the exchange rate risk on to its customers. Exporters can also buy forward contracts for an exchange rate fixed at a future date.

An unpublished survey of corporate treasurers by Record Treasury Management, a London consultancy, found that 77 per cent of respondents used forward contracts and other currency derivatives.

But Les Halpin, chief executive of RTM, said while many companies were happy to use derivatives to hedge their cash positions, almost none was prepared to use similar instruments to protect profits earned overseas.

The result is companies with substantial overseas operations, such as BOC, Imperial Chemical Industries and Reuters, have reported translation losses in converting foreign profits. ICI said interim pre-tax profits were down £90m because of the rapid rise in sterling. It attributed £30m to the translation into sterling.

So why not use derivatives to hedge translation costs? UK companies rarely do, according to Mr Halpin, because they often don't understand them.

The RTM survey found that 30 per cent said 'complexity' was the main risk in using derivatives. 'Most company executives think a hedge is something they get their gardener to trim,' grumbled one City equities analyst.

Another 35 per cent of treasurers said 'lack of control' was a significant risk – the fear that the spirit of Nick Leeson may live in a graduate trainee within the finance department. Since future profit levels are unknown, deciding how much to hedge is one barrier.

Sandvik, the Swedish industrial group, was recently caught out by currency hedging, as it reported an 18 per cent fall in first-half profits. In its case, the weakening of the krona meant its hedged positions made a loss.

UK finance directors are reluctant to hedge for several reasons. Profits lost in translation can often be 'paper losses' – it is only when the profits are converted into sterling that a loss is made. And there are complex accounting problems for representing derivatives on balance sheets, especially for instruments spanning several years.

But the most important reservation may be psychological.

If a corporate treasurer gets permission to hedge overseas earnings, and a currency shift makes the hedge unnecessary, then the cost and blame for the decision can be easily identified. But if the treasurer decides not to hedge, then the company is at the whim of the currency markets, an act of God for which no one is responsible.

Ironically, many corporate treasurers are happy to let their organisations dabble

in currency speculation – even though treasurers are no better than anyone else in predicting rate movements.

In 1996, RTM asked them to predict sterling's rate against the D-Mark in a year's time. The highest reply was DM2.50. A year later, the pound rose above DM3.02 – 25 per cent more than the average forecast of DM2.40.

Hedging cannot protect a company from extended currency movements.

John Rennocks, finance director of British Steel, said: 'Hedging is an important part of any exporter's business activity, but can only defer the impact of violent currency swings.'

But, Mr Halpin replied, well judged hedging can give a company 'breathing space', enabling it to take decisions on moving production or resources before the full impact of a currency swing is felt.

### EXHIBIT 21.7 When a hedge is not a gardner's problem

Source: *Financial Times* 18 August 1997

## Managing economic risk

Economic exposure is concerned with the long-term effects of forex movements on the firm's ability to compete, and add value. These effects are very difficult to estimate in advance, given their long-term nature, and therefore the hedging techniques described for transaction risk are of limited use. The forwards markets may be used to a certain extent, but these only extend for a short period for most currencies. Also the matching principle could be employed, whereby overseas assets are matched as far as possible by overseas liabilities.

The main method of insulating the firm from economic risk is to position the company in such a way as to maintain maximum flexibility – to be able to react to changes in forex rates which may be causing damage to the firm. Internationally diversified firms may have a greater degree of flexibility than those based in one or two markets. For example, a company with production facilities in numerous countries can shift output to those plants where the exchange rate change has been favorable. The international car assemblers have an advantage here over the purely domestic producer.

Forex changes can impact on the costs of raw materials and other inputs. By maintaining flexibility in sourcing supplies a firm could achieve a competitive advantage by deliberately planning its affairs so that it can switch suppliers quickly and cheaply.

**Forex changes can impact on the costs of raw materials and other inputs.**

An aware multinational could allow for forex changes when deciding in which countries to launch an advertising campaign. For example, it may be pointless increasing marketing spend in a country whose currency has depreciated rapidly recently, making the domestically produced competing product relatively cheap. It might also be sensible to plan in advance the company's response to a forex movement with regard to the pricing of goods so that action can be rapid. For example, a UK company

**Being prepared may avert an erroneous knee-jerk decision.**

exporting to Norway at a time when sterling is on a rising trend can either keep the product at the same price in sterling terms to maintain profits and face the consequential potential loss of market share, or reduce the sterling price to maintain a constant price in krone and thereby keep its market share. Being prepared may avert an erroneous knee-jerk decision. PSA Peugeot Citroen chose to reduce UK sales rather than price when the euro was high against the pound in 2003.

The principle of contingency planning to permit quick reaction to forex changes applies to many areas of marketing and production strategies. This idea links with the notion of the real option described in Chapter 20. The option to switch sources of supply and output, or to change marketing focus, may have a high value. Despite the cost of creating an adaptable organization, rather than a dedicated fixed one, the option to switch may be worth far more in an uncertain world.

Exhibit 21.8 describes the moves made by a number of UK companies to reduce their economic risk exposure by setting up manufacturing operations in a range of countries.

## A test of company strategy

Peter Marsh

The US employees of Industrial Acoustics Company, a Winchester-based business that is a world leader in making noise-proof enclosures for installations such as jet testing centres and power stations, could soon be among the beneficiaries of the dollar's weakening.

Brian Quarendon, the company's chief executive, says he is considering switching the manufacture of anti-noise products to IAC's New York plant to meet strong demand from the Middle East. They will be made more cheaply in the US than in the company's factories in the UK and continental Europe. We are hoping for another \$25m worth of business in the Middle East in the next two years. The way the dollar has been moving, I envisage most of this being produced from the US,' says Mr Quarendon.

IAC's reaction to the dollar's fragility illustrates the way company managers are thinking about altering their strategies now that several years of relative currency stability appear to be ending. If the dollar's weakness continues and the euro maintains its new-found robustness, how much opportunity does this give UK-based businesses to change the way they operate?

In the short term, the winners are UK-based companies exporting to the rest of Europe. The losers are those selling to dollar-denominated regions, including China and other nations in south-east Asia.

But according to Sir David Lees, chairman of the GKN engineering group, many UK companies are now so internationally spread that they are highly unlikely to make big changes in strategy on the back of short-term currency shifts.

'In GKN's case, we would never decide to switch production from our plants in Germany to the US on the grounds that the dollar has become weak,' says Sir David. 'In six months' time, the situation could reverse and we'd have to switch back again.'

The case of Imperial Chemical Industries shows how globalisation strategies provide inbuilt protection against currency swings. Two decades ago, any sudden weakening of sterling against continental European currencies would have boosted ICI, which was then a large maker of commodity chemicals sold globally but produced mainly in the UK. Today ICI mainly makes smaller-volume, high-value materials that are produced in plants around the world and used in markets close by. Therefore, the company says, the dollar's weakness makes little difference to how it seeks to run its business.

JCB, the UK's biggest maker of construction machinery, is another case in point. Until four years ago, all the company's plants were in Britain, giving the business much more exposure to changes in exchange rates. JCB now has several factories outside the UK, including a US plant employing 200.

'To some degree we anticipated the kind of change [the dollar weakening] that we have seen in the past few months,' says John Patterson, JCB's chief executive. 'Having our own US factory puts us in a much better position to respond if currencies move in an unexpected manner.'

In the past few years, many UK-based manufacturers have also sourced more parts from companies based in continental Europe, capitalising on the euro's relative weakness at the time.

Because UK industry has spread its risk to currency swings in this way, Harry Rawlinson, managing director of Aqualisa, a Kent-based shower manufacturer, says that today 'it is a moot point' whether it is in the best interests of UK industry for the pound to be strong or weak against the euro.

If most of UK industry has less reason to worry about currency swings than in the past, most industrial managers would argue that this is how it should be: rather than spend time fretting about the ups and downs of currencies, they can get on with making and selling better products.

## EXHIBIT 21.8 A test of company strategy

Source: *Financial Times* 10/11 January 2004

## Conclusion

Managers need to be aware of, and to assess, the risk to which their firms are exposed. The risk that arises because exchange rates move over time is one of the most important for managers to consider. Once the extent of the exposure is known managers then need to judge what, if anything, is to be done about it. Sometimes the threat to the firm and the returns to shareholders are so great as to call for robust risk-reducing action. In other circumstances the cost of hedging outweighs the benefit. Analyzing and appraising the extent of the problem and weighing up alternative responses are where managerial judgment comes to the fore.

**Managers need to be aware of, and to assess, the risk to which their firms are exposed.**



Knowledge of derivatives markets and money markets, and of the need for flexible manufacturing, marketing and financing structures, is useful background, but the key managerial skill required is discernment in positioning the company to cope with forex risk. The ability sometimes to stand back from the fray, objectively assess the cost of each risk-reducing option and say, 'No, this risk is to be taken on the chin because in my judgment the costs of managing the risk reduce shareholder wealth with little to show for it,' is sometimes required.

## Websites

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<a href="http://www.bis.org">www.bis.org</a>	Bank for International Settlements
<a href="http://www.bloomberg.co.uk">www.bloomberg.co.uk</a>	Bloomberg
<a href="http://www.reuters.co.uk">www.reuters.co.uk</a>	Reuters
<a href="http://www.ft.com">www.ft.com</a>	<i>Financial Times</i>
<a href="http://www.bankofengland.co.uk">www.bankofengland.co.uk</a>	Bank of England
<a href="http://www.ecb.int">www.ecb.int</a>	European Central Bank
<a href="http://www.nybot.com">www.nybot.com</a>	New York Board of Trade (FINEX)
<a href="http://www.cme.com">www.cme.com</a>	Chicago Mercantile Exchange

## Notes

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- 1 It is also shortened to FX.
- 2 The figures for 2004 will be published by the Bank For International Settlements in its triannual survey in the autumn/winter of 2004. See [www.bis.org](http://www.bis.org)
- 3 The *Financial Times* takes a representative sample of rates from major dealers in London at 4 p.m.
- 4 If we ignore the marketmakers' bid/offer spread and transaction costs.
- 5 The CME and FINEX trades later months than those shown by the FT, but these, again, are usually at three-month intervals.
- 6 With some currency option contracts the exercise can take place any time up to the expiry date, rather than only on the expiry date.
- 7 Assuming, for the sake of simplicity, no diminution of asset value in dollar terms.

# Appendix I

## FUTURE VALUE OF £1 AT COMPOUND INTEREST

Interest rates (%)

Periods	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.0100	1.0200	1.0300	1.0400	1.0500	1.0600	1.0700	1.0800	1.0900	1.1000	1.1100	1.1200	1.1300	1.1400	1.1500
2	1.0201	1.0404	1.0609	1.0816	1.1025	1.1236	1.1449	1.1664	1.1881	1.2100	1.2321	1.2544	1.2769	1.2996	1.3225
3	1.0303	1.0612	1.0927	1.1249	1.1576	1.1910	1.2250	1.2597	1.2950	1.3310	1.3676	1.4049	1.4429	1.4815	1.5209
4	1.0406	1.0824	1.1255	1.1699	1.2155	1.2625	1.3108	1.3605	1.4116	1.4641	1.5181	1.5735	1.6305	1.6890	1.7490
5	1.0510	1.1041	1.1593	1.2167	1.2765	1.3388	1.4026	1.4693	1.5386	1.6105	1.6851	1.7623	1.8424	1.9254	2.0114
6	1.0615	1.1262	1.1941	1.2653	1.3401	1.4185	1.5007	1.5869	1.6771	1.7716	1.8704	1.9738	2.0820	2.1950	2.3131
7	1.0721	1.1487	1.2299	1.3159	1.4071	1.5036	1.6058	1.7138	1.8280	1.9487	2.0762	2.2107	2.3526	2.5023	2.6600
8	1.0829	1.1717	1.2668	1.3686	1.4775	1.5938	1.7182	1.8509	1.9926	2.1436	2.3045	2.4760	2.6584	2.8526	3.0590
9	1.0937	1.1951	1.3048	1.4233	1.5513	1.6895	1.8385	1.9990	2.1719	2.3579	2.5580	2.7731	3.0040	3.2519	3.5179
10	1.1046	1.2190	1.3439	1.4802	1.6289	1.7908	1.9672	2.1589	2.3674	2.5937	2.8394	3.1058	3.3946	3.7072	4.0456
11	1.1157	1.2434	1.3842	1.5395	1.7103	1.8983	2.1049	2.3316	2.5804	2.8531	3.1518	3.4785	3.8359	4.2262	4.6524
12	1.1268	1.2682	1.4258	1.6010	1.7959	2.0122	2.2522	2.5182	2.8127	3.1384	3.4985	3.8906	4.3345	4.8179	5.3503
13	1.1381	1.2936	1.4685	1.6651	1.8856	2.1329	2.4098	2.7196	3.0658	3.4523	3.8833	4.3635	4.8980	5.4924	6.1528
14	1.1495	1.3195	1.5126	1.7317	1.9799	2.2609	2.5785	2.9372	3.3417	3.7975	4.3104	4.8871	5.5348	6.2613	7.0757
15	1.1610	1.3459	1.5580	1.8009	2.0789	2.3966	2.7590	3.1722	3.6425	4.1772	4.7846	5.4736	6.2543	7.1379	8.1371
16	1.1726	1.3728	1.6047	1.8730	2.1829	2.5404	2.9522	3.4259	3.9703	4.5950	5.3109	6.1304	7.0673	8.1372	9.3576
17	1.1843	1.4002	1.6528	1.9479	2.2920	2.6928	3.1588	3.7000	4.3276	5.0545	5.8951	6.8660	7.9861	9.2765	10.7613
18	1.1961	1.4282	1.7024	2.0258	2.4066	2.8543	3.3799	3.9960	4.7171	5.5599	6.5436	7.6900	9.0243	10.5752	12.3755
19	1.2081	1.4568	1.7535	2.1068	2.5270	3.0256	3.6165	4.3157	5.1417	6.1159	7.2633	8.6128	10.1974	12.0557	14.2318
20	1.2202	1.4859	1.8061	2.1911	2.6533	3.2071	3.8697	4.6610	5.6044	6.7275	8.0623	9.6463	11.5231	13.7455	16.3665
25	1.2824	1.6406	2.0938	2.6658	3.3864	4.2919	5.4274	6.8485	8.6231	10.8347	13.5855	17.0001	21.2305	26.4619	32.9190
30	1.6000	1.1700	1.1800	1.1900	1.2000	1.2100	1.2200	1.2300	1.2400	1.2500	1.2600	1.2700	1.2800	1.2900	1.3000
1	1.1600	1.1700	1.1800	1.1900	1.2000	1.2100	1.2200	1.2300	1.2400	1.2500	1.2600	1.2700	1.2800	1.2900	1.3000
2	1.3456	1.3689	1.3924	1.4161	1.4400	1.4641	1.4884	1.5129	1.5376	1.5625	1.5876	1.6129	1.6384	1.6641	1.6900
3	1.5609	1.6016	1.6430	1.6852	1.7280	1.7716	1.8158	1.8609	1.9066	1.9531	2.0004	2.0484	2.0972	2.1467	2.1970
4	1.8106	1.8739	1.9388	2.0053	2.0736	2.1436	2.2153	2.2889	2.3642	2.4414	2.5205	2.6014	2.6844	2.7692	2.8561
5	2.1003	2.1924	2.2878	2.3864	2.4883	2.5937	2.7027	2.8153	2.9316	3.0518	3.1758	3.3038	3.4360	3.5723	3.7129
6	2.4364	2.5652	2.6996	2.8398	2.9860	3.1384	3.2973	3.4628	3.6352	3.8147	4.0015	4.1959	4.3980	4.6083	4.8268
7	2.8262	3.0012	3.1855	3.3793	3.5832	3.7975	4.0227	4.2593	4.5077	4.7684	5.0419	5.3288	5.6295	5.9447	6.2749
8	3.2784	3.5115	3.7589	4.0214	4.2998	4.5950	4.9077	5.2389	5.5895	5.9605	6.3528	6.7675	7.2058	7.6686	8.1573
9	3.8030	4.1084	4.4355	4.7854	5.1598	5.5599	5.9874	6.4439	6.9310	7.4506	8.0045	8.5946	9.2234	9.8925	10.6045
10	4.4114	4.8068	5.2338	5.6947	6.1917	6.7275	7.3046	7.9259	8.5944	9.3132	10.0857	10.9153	11.8059	12.7614	13.7858
11	5.1173	5.6240	6.1759	6.7767	7.4301	8.1403	8.9117	9.7489	10.6571	11.6415	12.7080	13.8625	15.1116	16.4622	17.9216
12	5.9360	6.5801	7.2876	8.0642	8.9161	9.8497	10.8722	11.9912	13.2148	14.5519	16.0120	17.6053	19.3428	21.2362	23.2981
13	6.8858	7.6987	8.5994	9.5964	10.6993	11.9182	13.2641	14.7491	16.3863	18.1899	20.1752	22.3588	24.7588	27.3947	30.2875
14	7.9875	9.0075	10.1472	11.4198	12.8392	14.4210	16.1822	18.1414	20.3191	22.7374	25.4207	28.3957	31.6913	35.3391	39.3738
15	9.2655	10.5387	11.9737	13.5895	15.4070	17.4494	19.7423	22.3140	25.1956	28.4217	32.0301	36.0625	40.5648	45.5875	51.1859
16	10.7480	12.3303	14.1290	16.1715	18.4884	21.1138	24.0856	27.4462	31.2426	35.6271	40.3579	45.7994	51.9230	58.8079	66.5417
17	12.4627	14.4265	16.6722	19.2441	22.1861	25.5477	29.3844	33.7588	38.7408	44.4089	50.8510	58.1652	66.4614	75.8821	86.5042
18	14.4625	16.8790	19.6733	22.9005	26.6233	30.9127	35.8490	41.5233	48.0386	55.5112	64.0722	73.8698	85.0706	97.8822	112.4554
19	16.7765	19.7484	23.2144	27.2516	31.9480	37.4043	43.7358	51.0737	59.3889	69.3889	80.7310	93.8147	108.8904	126.2422	146.1920
20	19.4608	23.1056	27.3930	32.4294	38.3376	45.2593	53.3576	62.8206	73.8641	86.7362	101.7211	119.1446	139.3797	162.8524	190.0496
25	40.8742	50.6578	62.6686	77.3881	95.3962	117.3909	144.2101	176.8593	216.5420	264.6978	323.0454	393.6344	478.9049	581.7585	705.6410





# Appendix IV

## FUTURE VALUE OF AN ANNUITY OF £1 AT COMPOUND INTEREST

Periods	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	25	30	35	40	45	50
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	2.0400	2.0500	2.0600	2.0700	2.0800	2.0900	2.1000	2.1200	2.1400	2.1600	2.1800	2.2000	2.2500	2.3000	2.3500	2.4000	2.4500	2.5000
3	3.0301	3.0604	3.0909	3.1216	3.1525	3.1836	3.2149	3.2464	3.2781	3.3100	3.3744	3.4396	3.5056	3.5724	3.6400	3.8125	3.9900	4.1725	4.3600	4.5525	4.7500
4	4.0604	4.1216	4.1836	4.2465	4.3101	4.3746	4.4399	4.5061	4.5731	4.6410	4.7793	4.9211	5.0665	5.2154	5.3680	5.7646	6.1870	6.6329	7.1040	7.6011	8.1250
5	5.1010	5.2040	5.3091	5.4163	5.5256	5.6371	5.7507	5.8666	5.9847	6.1051	6.3528	6.6101	6.8771	7.1542	7.4416	8.2070	9.0431	9.9544	10.9456	12.0216	13.1875
6	6.1520	6.3081	6.4684	6.6330	6.8019	6.9753	7.1533	7.3359	7.5233	7.7156	8.1152	8.5355	8.9775	9.4420	9.9299	11.2588	12.7560	14.4834	16.3238	18.4314	20.7813
7	7.2135	7.4343	7.6625	7.8983	8.1420	8.3938	8.6540	8.9228	9.2004	9.4872	10.0890	10.7305	11.4139	12.1415	12.9159	15.0735	17.5828	20.4919	23.8534	27.7255	32.1719
8	8.2857	8.5830	8.8923	9.2142	9.5491	9.8975	10.2598	10.6366	11.0285	11.4359	12.2997	13.2328	14.2401	15.3270	16.4991	19.8419	23.8577	28.6640	34.3947	41.2019	49.2578
9	9.3685	9.7546	10.1591	10.5828	11.0266	11.4913	11.9780	12.4876	13.0210	13.5795	14.7757	16.0853	17.5185	19.0857	20.7989	25.8023	32.0150	39.6964	49.1526	60.7428	74.886
10	10.4622	10.9497	11.4639	12.0061	12.5779	13.1808	13.8164	14.4866	15.1929	15.9374	17.5487	19.3373	21.3215	23.5213	25.9587	33.2529	42.6195	54.5902	69.8137	89.0771	113.330
11	11.5668	12.1687	12.8078	13.4864	14.2068	14.9616	15.7536	16.6455	17.5603	18.5313	20.6546	23.0445	25.7329	28.7551	32.1504	42.5661	56.4053	74.6967	98.7391	130.162	170.995
12	12.6825	13.4121	14.1920	15.0258	15.9171	16.8699	17.8885	18.9771	20.1407	21.3843	24.1331	27.2707	30.8502	34.9311	39.5805	54.2077	74.3270	101.841	139.235	189.735	257.493
13	13.8093	14.6803	15.6178	16.6268	17.7130	18.8821	20.1406	21.4953	22.9534	24.5227	28.0291	32.0887	36.7862	42.2187	48.4966	68.7596	97.6250	138.485	195.929	276.115	387.239
14	14.9474	15.9739	17.0663	18.2919	19.5986	21.0151	22.5505	24.2149	26.0192	27.9750	32.3926	37.5811	43.6720	50.8180	59.1959	86.9495	127.913	187.954	275.300	401.367	581.859
15	16.0969	17.2934	18.5989	20.0236	21.5786	23.2760	25.1290	27.1521	29.3609	31.7725	37.2797	43.8424	51.6595	60.9653	72.0351	109.687	167.286	254.738	386.420	582.982	873.788
16	17.2579	18.6393	20.1569	21.8245	23.6575	25.6725	27.8881	30.3243	33.0034	35.9497	42.7533	50.9804	60.9250	72.9390	87.4421	138.109	218.472	344.897	541.988	846.324	1311.68
17	18.4304	20.0121	21.7616	23.6975	25.8404	28.2129	30.8402	33.7502	36.9737	40.5447	48.8837	59.1176	71.6730	87.0680	105.931	173.636	285.014	466.611	759.784	1228.17	1968.52
18	19.6147	21.4123	23.4144	25.6454	28.1324	30.9057	33.9990	37.4502	41.3013	45.5992	55.7497	68.3941	84.1407	103.740	128.117	218.045	371.518	630.925	1064.70	1781.85	2953.78
19	20.8109	22.8406	25.1169	27.6712	30.5390	33.7600	37.3790	41.4463	46.0185	51.1591	63.4397	78.9692	98.6032	123.414	154.740	273.556	483.973	852.748	1491.58	2584.68	4431.68
20	22.0190	24.2974	26.98704	29.7781	33.0660	36.7856	40.9955	45.7620	51.1601	57.2750	72.0524	91.0249	113.380	146.628	186.688	342.945	630.165	1152.21	2089.21	3748.78	6648.51
25	28.2432	32.0303	36.4593	41.6459	47.7271	54.8645	63.2490	73.1059	84.7009	93.3471	133.334	181.871	249.214	42.603	471.981	1054.79	2348.80	5176.50	11247.1990	24040.7	50500.3
30	34.7849	40.5681	47.5754	56.0849	66.4388	79.0582	94.4608	113.83	136.308	164.494	241.333	356.787	530.312	790.948	1181.88	3227.17	8729.99	23221.6	60501.1	154107	383.500
35	41.6603	49.9945	60.4621	73.6522	90.3203	111.435	138.237	173.317	215.711	271.022	431.663	93.573	1120.71	1816.65	2948.34	9856.76	32422.9	104136	325400	987794	2912217
40	48.8864	60.4020	75.4013	95.0255	120.800	154.762	199.635	259.057	337.882	442.593	767.091	1342.03	2360.76	4163.21	7343.86	30088.7	120393	466960	1750092	6331512	22114663
45	56.4811	71.8927	92.7199	121.029	159.700	212.744	285.749	368.504	525.859	718.905	1358.23	2590.56	4965.27	9531.58	18281.3	91831.5	447019	2093876	9412424	40583319	167933233
50	64.4632	84.5794	112.797	152.667	208.348	290.336	406.529	573.770	815.084	1163.91	2400.02	4994.52	10435.6	21813.1	45497.2	280256	1659761	9389020	50622288	260128295	1275242998