CHAPTER 1

# Foreign Exchange Basics



I start with some basic knowledge about foreign exchange that the reader will want to have before tackling currency options.

## THE FOREIGN EXCHANGE MARKET

An exchange rate is a market price at which one currency can be exchanged for another. Exchange rates are sometimes called pairs because there are always two currencies involved. If the exchange rate for Japanese yen in terms of U.S. dollars is 90.00, it is meant that yen can be traded for dollars—or dollars traded for yen—at the rate of $1 for 90.00 yen.

A spot foreign exchange transaction (or deal)[1] is an agreement to exchange sums of currencies, usually in two bank business days' time. This transaction is the core of the foreign exchange market. A forward transaction is a deal done for settlement, or value, at a time beyond spot value day. There are two kinds of forwards. Forward outrights are similar to spot deals. The exchange rate is agreed when the deal is done on the trade date, but currencies settle at times in the future further out on the settlement calendar, say in a week, or a month, or in many months. A forward swap is the combination of a spot deal and a forward deal done in opposite directions. Forward outrights and forward swaps will be covered in detail later in this chapter.

It is well known that the foreign exchange market is a very large market, but exactly how large is hard to say. Our single best source as to the size and structure of the worldwide foreign exchange market is an extensive survey of trading done by the Bank for International Settlements (BIS) in

[1]Legal definitions of the vocabulary of foreign exchange dealing can be found in International Swaps and Derivatives Association, Inc. (1998).

conjunction with the central banks of 50 or so nations.[2] The most recent survey, published in 2010 (BIS 2010), documented the virtual explosion in foreign exchange trading since the previous surveys done in 2007, 2004, and 2001. After adjustments for double counting,[3] $4 trillion of foreign exchange changed hands per day in April 2010 compared to $3.3 trillion, $1.9 trillion, and $1.2 trillion in April of 2007, 2004, and 2001, respectively. These statistics cover transactions in spot, forward outright, forward swaps, currency swaps, and options (Exhibit 1.1).[4] There are at least two other recent central-bank-sponsored surveys covering specific segments of the foreign exchange market, both dating from October 2009. A Bank of England survey[5] of the London market (BOE 2009) estimated $1,430 billion in total daily turnover (including spot, outright forwards, non-deliverable forwards, and foreign exchange swaps). A Federal Reserve Bank of New York (NYFED 2009) survey[6] of the New York market estimated $679 billion of trading the same instruments.

Foreign exchange trading is done practically everywhere there is a banking center. According to the BIS 2010 survey, the largest centers by share of total world turnover were the United Kingdom (37 percent), the United States (18 percent), Japan (6 percent), Singapore (5 percent), Switzerland (5 percent), Hong Kong (5 percent), and Australia (4 percent). Not to be forgotten are the emerging markets nations where recently published data (BIS; Mihaljek and Packer 2010) (Exhibit 1.1) show to be rapidly expanding centers for foreign exchange trading.

There are well more than 100 currencies. As a general rule practically every country has its own currency[7] (with the European countries in the



[2]The practical reality is that the BIS and the central banks are in a unique position to accumulate such information because foreign exchange is an over-the-counter market that is conducted by commercial banks around the world. Unlike equities, for example, there is no central "tape" where trades are publicly posted.

[3]Every trade involves two counterparties. The BIS survey adjusts for double counting, meaning that a trade counts only once. For example, suppose Bank A buys 100 million dollar/yen from Bank B. Adjusting for double counting means that this would be counted as a single trade of 100 million of dollar/yen.

[4]For comparison, BIS (2010) reports that turnover in interest rate forward rate agreements and interest rate swaps were $600 billion and $1,275 billion, respectively in 2010.

[5]The Bank of England (BOE 2009) sponsored the Foreign Exchange Joint Standing Committee's survey of 31 institutions active in the foreign exchange market.

[6]The Federal Reserve Bank of New York (NYFED 2009) sponsored the Foreign Exchange Committee's survey of 25 participating institutions.

[7]See DeRosa (2009).

| | Total Global Turnover (1) | | | | | Turnover in Emerging Markets (2) | | |
|---|---|---|---|---|---|---|---|---|
| | 1998 | 2001 | 2004 | 2007 | 2010 | 2004 | 2007 | 2010 |
| Spot transactions | 568 | 386 | 631 | 1,005 | 1,490 | 119 | 188 | 203 |
| Outright forwards | 128 | 130 | 209 | 362 | 475 | 21 | 47 | 73 |
| Foreign exchange swaps | 734 | 656 | 954 | 1,714 | 1,765 | 125 | 231 | 277 |
| Currency swaps | 10 | 7 | 21 | 31 | 43 | 3 | 4 | 7 |
| Options and other products | 87 | 60 | 119 | 212 | 207 | 10 | 18 | 24 |
| Total | 1,527 | 1,239 | 1,934 | 3,324 | 3,981 | 279 | 489 | 585 |
| Memo: Turnover at April 2010 Exchange Rates | 1,705 | 1,505 | 2,040 | 3,370 | 3,981 | | | |
| Exchange-traded derivatives | 11 | 12 | 26 | 80 | 168 | | | |
| Global turnover by counterparty | | | | | | | | |
| *With reporting dealers* | 961 | 719 | 1,018 | 1,392 | 1,548 | | | |
| *With other financial institutions* | 299 | 346 | 634 | 1,339 | 1,900 | | | |
| *With non-financial customers* | 266 | 174 | 276 | 593 | 533 | | | |

**EXHIBIT 1.1** Global Foreign Exchange Market Turnover (Daily Averages in April, in Billions of U.S. Dollars)
*Source:* (1) BIS (2010) and (2) Mihaljek and Packer (2010).

euro zone being a prominent, but not unique, exception). Yet trading in the foreign exchange market is remarkably concentrated in a handful of exchange rates (Exhibit 1.2). What is noteworthy is that the sum of trading in the dollar against the euro, yen, and sterling (in order of volume) made up 51 percent of all foreign exchange trading in 2010. In one sense, the foreign exchange market is largely the price of the dollar, inasmuch as in 2010 the dollar was on one side of 84.9 percent of all trades[8,9] (followed by the euro (39.1 percent), the yen (19.0 percent), sterling (12.9 percent), and the Australian dollar (7.6 percent).[10] But even a currency with a small share of total turnover can have a large volume of trading because the overall size of the market is enormous.

Foreign exchange dealing has become steadily more concentrated among a handful of powerful dealing banks. Indeed, according to the BIS, the top five dealers captured more than 55 percent of the market by 2009, up from a little more than 25 percent in 1999 (see Gallardo and Heath 2009).[11] At the same time that trading in foreign exchange has been growing, the number of banks doing large-scale foreign exchange trading has been shrinking. Roughly speaking, the number of money center banks that account for 75 percent of foreign exchange turnover has roughly dropped by two-thirds in the period between 1998 and 2010 (BIS 2010). On a geographic basis, the number of such banks shrunk from 24 to 9 in the U.K., from 20 to 7 in the United States, from 7 to 2 in Switzerland, from 19 to 8 in Japan, and from 23 to 10 in Singapore during this decade. This is probably best seen as an outcome of the general trend of consolidation in the financial services industry. In the meantime the development of electronic trading has materially altered the nature of the foreign exchange market. The lower section of Exhibit 1.1 shows global foreign exchange turnover by counterparty to the reporting banks. Note that the historical pattern is for dealing banks



[8] The percentage share of the dollar was 85.6 and 88.0 in the 2007 and 2004 surveys, respectively.

[9] The BIS (2007) survey addressed the question of the euro's challenge to the dollar's dominance: "Expectations that the euro might challenge the U.S. dollar's dominance in the FX market have not been borne out. While dollar/euro remained the most important currency pair traded, accounting for 27% of total turnover measured in notional amounts, only 8% of all trades involved the euro and a currency other than the dollar" (page 15).

[10] The BIS (2007) survey estimated that 23 emerging-markets currencies tracked in the survey were 19.8 percent and 15.4 percent of trading in 2007 and 2004, respectively.

[11] Gallardo and Heath (2009) present a graph from which I have taken approximate numbers as to degree of concentration of foreign exchange dealing. See their Graph 1, left-hand Panel, their page 85.

**EXHIBIT 1.2** Reported Foreign Exchange Market Turnover by Currency Pair (Daily Averages in April, in Billions of U.S. Dollars and Percent)

| | 2001 | | 2004 | | 2007 | | 2010 | |
|---|---|---|---|---|---|---|---|---|
| | Amount | % Share | Amount | % Share | Amount | % Share | Amount | % Share |
| U.S. dollar/euro | 372 | 30% | 541 | 28% | 892 | 27% | 1101 | 28% |
| U.S. dollar/yen | 250 | 20% | 328 | 17% | 438 | 13% | 568 | 14% |
| Sterling/U.S. dollar | 129 | 10% | 259 | 13% | 384 | 12% | 360 | 9% |
| Australian dollar/U.S. dollar | 51 | 4% | 107 | 6% | 185 | 6% | 249 | 6% |
| U.S. dollar/Swiss franc | 59 | 5% | 83 | 4% | 151 | 5% | 168 | 4% |
| U.S. dollar/Canadian dollar | 54 | 4% | 77 | 4% | 126 | 4% | 182 | 5% |
| U.S. dollar/Swedish krona | 6 | 0% | 7 | 0% | 57 | 2% | 45 | 1% |
| U.S. dollar/Other | 193 | 16% | 300 | 16% | 612 | 18% | 705 | 18% |
| Euro/yen | 36 | 3% | 61 | 3% | 86 | 3% | 111 | 3% |
| Euro/Sterling | 27 | 2% | 47 | 2% | 69 | 2% | 109 | 3% |
| Euro/Swiss franc | 13 | 1% | 30 | 2% | 62 | 2% | 72 | 2% |
| Euro/other | 22 | 2% | 44 | 2% | 123 | 4% | 162 | 4% |
| Other currency pairs | 28 | 2% | 50 | 3% | 139 | 4% | 149 | 4% |
| All currency pairs | 1,239 | 101% | 1,934 | 100% | 2,324 | 100% | 3,981 | 100% |

*Source:* BIS (2010).

(i.e., "reporting" in the language of the BIS surveys) to trade primarily with other dealing banks. That pattern began to change as early as 2001. An explanation is that electronic trading has resulted in dealing banks now trading less with other dealing banks and more with other financial institutions that are not themselves dealing banks. The 2010 survey is the first time that the volume of trading between dealers and nondealers was reported to have been greater in volume than trading within the dealer community. The BIS category of nonreporting financial institutions includes smaller banks, mutual funds, money market funds, insurance companies, pension funds, hedge funds, currency funds, and central banks, among others.[12] The magnitude of this shift is remarkable when one considers that 85 percent of the increase in the global turnover in foreign exchange originated from dealers trading with this category of other financial institutions.



## THE INTERNATIONAL MONETARY SYSTEM

### Bretton Woods and the Smithsonian Period

For the first quarter century after the Second World War, the international monetary system consisted of a program of fixed exchange rates. Fixed exchange rates were established under the Bretton Woods agreement signed by the Allied powers in 1944 in advance of the end of the Second World War. The Bretton Woods agreement required all member central banks to keep their foreign exchange reserves in U.S. dollars, pounds Sterling, or gold. More importantly, member countries agreed to stabilize their currencies within a 1 percent band around a target rate of exchange to the U.S. dollar. The dollar, in turn, was pegged to gold bullion at $35 per ounce. Parts of the system lasted until 1971.

Periodically, currencies had to be revalued and devalued when market pressures became too great for central banks to oppose. Cynics dubbed the Bretton Woods a "system of creeping pegs." In 1971, after a series of dramatic "dollar crises," the dollar was devalued against gold to $38 an ounce,[13] and a wider bandwidth, equal to 2.25 percent, was established. This modification to the system, called the Smithsonian Agreement, postponed the collapse of the system of fixed exchange rates for two years.

[12]King and Rime (2010, p. 28).
[13]The devaluation of the dollar was mostly symbolic because the United States closed the gold window at the same time in 1971.

In 1973, President Richard Nixon scrapped the entire structure of fixed exchange rates that had begun with Bretton Woods. Since that time, exchange rates for the major currencies against the dollar have been floating.

## The Euro

On January 1, 1999, 11 European nation members of the European Monetary Union, Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain, adopted a new common currency, called the euro. The legacy currencies of these eleven nations, such as the German mark and French franc, circulated in parallel to the euro for a time but were exchangeable to the euro at fixed exchange rates. Total conversion to the euro happened on January 1, 2002, at which time the European Central Bank issued euro notes and coins. Additional countries have joined the euro since that time: Greece in 2001, Slovenia in 2007, Cyprus and Malta in 2008, Slovakia in 2009, and Estonia in 2011. At the current time 17 countries have adopted the euro. Noteworthy by their absence are the United Kingdom and Denmark. Switzerland is not part of the European Monetary Union.

The road to the creation of the euro was difficult. For nearly two decades, starting with the creation of the European Monetary System in March 1979, parts of Europe experimented with a fixed exchange rate system that was known as the Exchange Rate Mechanism (ERM). Under the ERM, member countries agreed to peg their currencies to a basket currency called the European Currency Unit (ECU). Currencies were allowed to move in relation to the ECU within either the narrow band of plus or minus 2.25 percent or the wide band of plus or minus 6 percent.

The ERM was a costly experiment in fixed exchange rate policy. In its 20 years of operation, from 1979 to 1999, ERM central rates had to be adjusted over 50 times. More spectacular yet were the two major ERM currency crises, one in September 1992 and the other in August 1993, each of which involved massive central bank losses in the defense of the fixed exchange rate grid. Finally after the second crisis, fluctuation bands were widened to plus or minus 15 percent, a move that effectively neutered the ERM.[14]



[14]The ERM still exists. For example, under "ERM II" the Danish krone is stabilized within a plus/minus 15 percent zone around a central rate. The Danish central bank further restricts movements in the unit to plus/minus 2.25 percent around the krone's central rate.

## Fixed Exchange Rate Regimes

A great variety of fixed exchange rate regimes have come and gone in the twentieth century, especially with respect to the minor currencies and emerging market currencies. Only a handful of fixed exchange rate systems have been worth the trouble. One success story was the Austrian shilling, which remained faithfully pegged to the German mark for nearly 20 years before joining the ERM in January 1995.

But there were a great many other cases of fixed exchange rate regimes that ended badly.[15] History shows that pegged exchange rates are astonishingly explosive and damaging when they fail. The examples of the Mexican peso in 1994, Thai baht, Czech koruna, Indonesian rupiah in 1997, and the Russian ruble in 1998 are cases in point.

Fixed exchange rate regimes in their most simple form consist of a currency being pegged outright to the value of another currency.[16] A few fixed exchange rate regimes are operated under the framework of a currency board, such as the one that is in place for the Hong Kong dollar. Under the workings of a currency board, the government commits to maintaining a reserve of foreign exchange equal to the outstanding domestic base money supply and to exchange domestic and foreign reserve currency at the pegged exchange rate upon demand.

Basket peg systems are another fixed exchange rate regime. The Thai baht was operated as a basket peg currency prior to its spectacular collapse in July 1997. Under the basket regime, the Bank of Thailand pegged the baht to a basket of currencies made up of U.S. dollars, German marks, and Japanese yen, though the exact makeup of the basket was never revealed.

Another species of a fixed exchange rate regime pegs the currency, but permits gradual depreciation over time. Examples are the Mexican peso prior to the December 1994 crisis and the Indonesian rupiah before it collapsed in July 1997.

Still other currencies fit somewhere between floating and pegged exchange rate regimes. Singapore, for example, operates what at times has been described as a managed floating regime.

## Exchange Rate Intervention

Since the end of the Bretton Woods–Smithsonian regimes, the value of the U.S. dollar against the currencies of America's major trading partners

[15]See DeRosa (2001) for discussions of exchange rate crises.
[16]See DeRosa (2009) for discussion of the variety of fixed exchange rate regimes in emerging markets nations.

has been determined by the forces of free-market supply and demand. This is a bit of an exaggeration because all exchange rates have at times been subject to manipulation through intervention by governmental bodies.

Intervention had a large presence in the foreign exchange market for a time in the 1980s. A predecessor of the current G-7 council,[17] called the G-5 council, initiated the Plaza intervention[18] in September 1985 (see Funabashi 1989). At that time, the council decided that a lower value for the dollar was warranted. Accordingly, its member nations' central banks launched a massive program to sell the dollar. The Plaza maneuver is remembered in foreign exchange history as the most successful coordinated intervention; the dollar fell by more than 4 percent in the first 24 hours. Two years later the council refocused its attention at the variability of exchange rates at another historic meeting, this time at the Louvre in February 1987.

But the appetite for intervention on the part of governments and their central banks ebbs and flows with economic circumstances and political leanings. For example, the administration of President George W. Bush seemed to have had no interest in foreign exchange intervention, whereas that of his predecessor, President Clinton, aggressively used intervention in an attempt to maintain what it called a strong dollar.

While most major central banks have given up on intervention, at least in current times, Japan remains convinced of the need to use intervention to manage the value and the volatility of the yen. Central banks of emerging markets nations regard foreign exchange intervention as an important tool to be used in parallel with monetary policy.



## Exchange Rate Crises

Exchange rate crises are primarily manifestations of fixed exchange rate arrangements coming to their end. These are brief periods of spectacular volatility, not only of exchange rates but also of associated interest rates, bond prices, and stock prices. Their history is important to traders and risk managers, not to mention economists.

[17]The G-7 stands for the Group of Seven industrialized nations, which is composed of the United States, Japan, Canada, the United Kingdom, Italy, Germany, and France. The G-5 did not include Italy and Canada. Today one hears of the G-8 which is the G-7 plus Russia.

[18]Curiously, these historically important accords tend to be named after either hotels (Bretton Woods and the Plaza) or museums (Smithsonian and Louvre).

The granddaddy of all foreign exchange crises was the aforementioned collapse of the Bretton Woods system of fixed exchange rates in August 1971.[19] The next-most-memorable crisis was in September 1992 during the ERM period before the launch of the euro. This was the episode that ended Great Britain's participation in the ERM and earned famed speculator George Soros the reputation for having "broke the Bank of England." August of 1993 is when the second ERM crisis occurred, principally involving the French franc's role in the ERM; 1994 saw the Mexican peso blow out of its crawling peg arrangement.

The Southeast Asian currencies experienced tremendous volatility in the summer of 1997. Two currencies, the Thai baht and the Indonesian rupiah, abandoned long-held fixed exchange rate regimes. The Malaysian ringgit and Philippine peso suffered steep losses in value against the U.S. dollar. The Korean won, a currency that was not fully convertible, also was devalued. One of the only convertible currencies in Asia not to be devalued was the Hong Kong dollar.

After the fact, basic macroeconomic analysis can explain this remarkable series of currency crises with a simple set of causal factors that relate to the fundamental domestic conditions in each of these countries. Many of the affected countries had banking systems that were on the verge of total breakdown before the exchange rate problems became manifest. Moreover, several countries were running enormous and unsustainable current account imbalances, and every one of the afflicted countries had managed to run up staggering foreign currency–denominated debts. Speaking of excessive debt, there are Russia (1998) and Argentina (2002) to consider. These were compound crises, in the sense that their fixed exchange rate regimes exploded at the same time their governments announced defaults on maturing sovereign debt.

Nonetheless, in some quarters, the blame for these episodes has been put on hedge funds and currency speculators. It is widely held that capital mobility invites disaster, mistaken though that belief is. No matter what ultimately one chooses to believe was the cause of the crisis or where one enjoys placing the blame, the history of fixed exchange rate regimes clearly demonstrates that exchange rates are capable of making violent and substantial—if not outright discontinuous—movements over short periods of time.



[19]One measure of how disruptive this crisis was is Root's (1978) report that after Nixon closed the gold window on August 15, 1971, West European governments kept their foreign exchange markets closed until August 23rd.

## SPOT FOREIGN EXCHANGE AND MARKET CONVENTIONS

### Spot Foreign Exchange

The spot exchange rate is a quotation for the exchange of currencies in two bank business days' time (except in the case of the Canadian dollar versus the U.S. dollar, where delivery is in one bank business day).

Foreign exchange settlement days are called value dates. To qualify as a value date, a day must not be a bank holiday in either currency's country and in almost all circumstances must not be a bank holiday in the United States as well.[20] Many traders rely on a specialized calendar called the Euromarket Day Finder published by Copp Clark Professional. A sample page of this calendar for trade date December 21, 2010, is displayed in Exhibit 1.3. Note that the value date for spot transactions on December 21, 2010, is December 23, 2010. An exception is Japan. Because December 23rd is an official holiday (the emperor's birthday), the value date for trades done on December 21, 2010, involving the yen is December 24, 2010.

The foreign exchange week commences on Monday morning at 6 A.M. Sydney time when New Zealand and Australian dealers open the market. Later, Tokyo, Singapore, and Hong Kong join the fray to constitute the Austral-Asian dealing time zone. Next, the center of the market shifts to London as it opens, but Frankfurt, Paris, Milan, Madrid, and Zurich also conduct currency dealing. New York is the capital of foreign exchange dealing in the Western Hemisphere. At 5 P.M. New York time, the day ends as trading seamlessly advances to the next value day.



### Quotation Conventions

Dealers make spot exchange rate quotations as bid-ask quotations. For example, a quote on $10 million dollar/yen of 89.98/90.00 means that a dealer is willing to buy dollars and sell yen at the rate of 89.98 yen per dollar or sell dollars and buy yen at the rate of 90.00 yen per dollar. The quantity of $1 million dollars is sometimes simply called 1 dollar. Also, $1 billion is sometimes called 1 yard of dollars.

[20]Because the deepest parts of the interbank forward market are quoted against the U.S. dollar, it can be difficult to calculate accurate cross-currency settlement on a U.S. dollar holiday. Thus while settlement is technically possible on U.S. holidays, it is generally avoided, especially for smaller, less-traded currencies.


**EXHIBIT 1.3** Euromarket Day Finder

**Tuesday DECEMBER 21, 2010**
Week 52

ACI THE FINANCIAL MARKETS ASSOCIATION

www.coppclark.com

**7 Jul 2011**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | 1 ⧗▲ | 2 |
| 3 | 4 ★ | 5 196 | 6 197 | 7 198 | 8 199 | 9 |
| 10 | 11 202 | 12 203 | 13 204 | 14 205 | 15 206 | 16 |
| 17 | 18 ● | 19 210 | 20 211 | 21 212 | 22 213 | 23 |
| 24 | 25 216 | 26 217 | 27 218 | 28 219 | 29 220 | 30 |
| 31 | | | | | | |

**8 Aug 2011**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | 1 ▼+▲ | 2 224 | 3 225 | 4 226 | 5 227 | 6 |
| 7 | 8 230 | 9 ♦ | 10 232 | 11 233 | 12 234 | 13 |
| 14 | 15 237 | 16 238 | 17 239 | 18 240 | 19 241 | 20 |
| 21 | 22 244 | 23 245 | 24 246 | 25 247 | 26 248 | 27 |
| 28 | 29 ■ | 30 252 | 31 ♦ | | | |

**9 Sep 2011**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | 1 254 | 2 255 | 3 |
| 4 | 5 ⧗▲ | 6 259 | 7 260 | 8 261 | 9 262 | 10 |
| 11 | 12 265 | 13 ⧗ | 14 267 | 15 268 | 16 269 | 17 |
| 18 | 19 ● | 20 273 | 21 274 | 22 275 | 23 ● | 24 |
| 25 | 26 279 | 27 280 | 28 281 | 29 282 | 30 283 | |

**10 Oct 2011**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | | 1 ⧗ |
| 2 | 3 ▼ | 4 287 | 5 ⧗ | 6 289 | 7 290 | 8 |
| 9 | 10 ★●▲ | 11 294 | 12 295 | 13 296 | 14 297 | 15 |
| 16 | 17 300 | 18 301 | 19 302 | 20 303 | 21 304 | 22 |
| 23 | 24 ▬ | 25 308 | 26 ♦ | 27 310 | 28 311 | 29 |
| 30 | 31 314 | | | | | |

**11 Nov 2011**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | 1 315 | 2 316 | 3 ● | 4 318 | 5 |
| 6 | 7 ♦ | 8 322 | 9 323 | 10 324 | 11 ★▲ | 12 |
| 13 | 14 328 | 15 329 | 16 330 | 17 331 | 18 332 | 19 |
| 20 | 21 335 | 22 336 | 23 ● | 24 ★ | 25 339 | 26 |
| 27 | 28 342 | 29 343 | 30 344 | | | |

**12 Dec 2011**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | 1 345 | 2 346 | 3 |
| 4 | 5 349 | 6 350 | 7 351 | 8 352 | 9 353 | 10 |
| 11 | 12 356 | 13 357 | 14 358 | 15 359 | 16 360 | 17 |
| 18 | 19 363 | 20 364 | 21 365 | 22 366 | 23 ● | 24 |
| | ▼€ ★ | ▼⧗€ ▬♦▲ ■+★ | ⧗▲ ■▼▬ | 28 372 | 29 373 | 30 374 | 31 ● |

**Moscow**

| 2010 RUB | 2011 |
|---|---|
| 1 Jan | 1 Jan |
| 2 Jan | 2 Jan |
| 3 Jan | 3 Jan |
| 4 Jan | 4 Jan |
| 5 Jan | 5 Jan |
| 6 Jan | 6 Jan |
| 7 Jan | 7 Jan |
| 8 Jan | 10 Jan |
| 23 Feb | 23 Feb |
| 8 Mar | 8 Mar |
| 3 May | 2 May |
| 10 May | 9 May |
| 14 Jun | 13 Jun |
| 4 Nov | 4 Nov |

**Riga**

| 2010 LVL | 2011 |
|---|---|
| 1 Jan | 1 Jan |
| 2 Apr | 22 Apr |
| 5 Apr | 25 Apr |
| 1 May | 1 May |
| 4 May | 4 May |
| 23 Jun | 23 Jun |
| 24 Jun | 24 Jun |
| 18 Nov | 18 Nov |
| 24 Dec | 24 Dec |
| 25 Dec | 25 Dec |
| 26 Dec | 26 Dec |
| 31 Dec | 31 Dec |

**Tallinn**

| 2010 EEK | 2011 |
|---|---|
| 1 Jan | 1 Jan |
| 24 Feb | 24 Feb |
| 2 Apr | 22 Apr |
| 1 May | 1 May |
| 23 Jun | 23 Jun |
| 24 Jun | 24 Jun |
| 20 Aug | 20 Aug |
| 24 Dec | 24 Dec |
| 25 Dec | 25 Dec |
| 26 Dec | 26 Dec |

**Vilnius**

| 2010 LTL | 2011 |
|---|---|
| 1 Jan | 1 Jan |
| 16 Feb | 16 Feb |
| 11 Mar | 11 Mar |
| 5 Apr | 25 Apr |
| 1 May | 1 May |
| 24 Jun | 24 Jun |
| 6 Jul | 6 Jul |
| 15 Aug | 15 Aug |
| 1 Nov | 1 Nov |
| 25 Dec | 25 Dec |
| 26 Dec | 26 Dec |

**Tel Aviv**

| 2010 ILS | 2011 |
|---|---|
| 28 Feb | 20 Mar |
| 30 Mar | 19 Apr |
| 5 Apr | 25 Apr |
| 20 Apr | 10 May |
| 19 May | 8 Jun |
| 20 Jul | 9 Aug |
| 9 Sep | 29 Sep |
| 10 Sep | 30 Sep |
| 17 Sep | 7 Oct |
| 18 Sep | 8 Oct |
| 23 Oct | 13 Oct |
| 30 Oct | 20 Oct |

EUROMARKET DAY FINDER®
Register today at www.goodbusinessday.com.

Tuesday DECEMBER 21



**EXHIBIT 1.3** (*Continued*)

P1: TIX/b P2: c/d QC: e/f T1: g
JWBT512-c01 JWBT512-DeRosa June 6, 2011 13:29 Printer: Yet to Come



A pip is defined as the smallest unit of quotation for a currency. Therefore, a quote on dollar/yen of 89.98/90.00 is said to be two pips wide.

Currency trading is a fast-moving business. Dealing room errors can be disastrously expensive. For that reason, the foreign exchange community has developed rules on how quotations and trading instructions are given. The most basic rule is that the first currency in an exchange rate pair is the direct object of the trade. By that I mean to buy $10 million dollar/yen is to buy $10 million dollars against yen. The hierarchy of exchange rates is as follows:

| | |
|---|---|
| EUR | Euro |
| GBP | Sterling |
| AUD | Australian Dollar |
| USD | U.S. Dollar |
| Non-Euro | Other European Currencies |
| JPY | Japanese yen |

The rule in the professional market is that the higher currency on the grid is the one that deals. For example, the euro deals against all currencies (EUR/GBP; EUR/USD; EUR/JPY).

Unfortunately, two conventions for the quotation of spot foreign exchange have evolved. In the American convention, currency is quoted in terms of U.S. dollars per unit of foreign exchange (for example, sterling quoted at 1.7000 means that it takes 1.7000 U.S. dollars to equal one pound). The pound, Australian dollar, New Zealand dollar, and the euro are quoted American. Other currencies are quoted "European," which means they are expressed in the number of units of foreign exchange equal to one U.S. dollar (i.e., 90.00 yen per one U.S. dollar or 1.0850 Swiss francs per one dollar).

One additional matter that makes things even more confusing is that most exchange-traded currency futures and options quote currencies American, even for currencies that are quoted European in the spot market.



## FOREIGN EXCHANGE DEALING

### Two-Way Prices

Foreign exchange dealers stand ready to make bid-ask quotes on potentially very large amounts of currency to customers as well as to other banks. There is a distinction in the interbank market between reciprocal and nonreciprocal trading relationships. In a reciprocal trading relationship, two banks

agree to supply each other with "two-way" (i.e., bid-ask) quotations upon demand. Reciprocal trading relationships, meaning those between money center banks, constitute the core of the foreign exchange market. A nonreciprocal trading relationship is merely a customer trading facility that happens to be between a small bank and a large money center–dealing bank. The dealer agrees to quote foreign exchange to the smaller bank, but the reverse is never expected to happen.

It is the custom in the foreign exchange market for the party soliciting a quote to reveal the size of the transaction at its onset. In the example in Exhibit 1.4, a hedge fund called Ballistic Trading is soliciting Martingale

**EXHIBIT 1.4** Hypothetical Foreign Exchange Dealing Conversation: Martingale Bank New York and Ballistic Trading

| | | |
|---|---|---|
| | **TO** | **MARTINGALE NY 0130GMT 030110** |
| | HIHI FRIENDS | |
| *1* | JPY 10 PLS | |
| *2* | # 98 00 | |
| *3* | I BUY | |
| *4* | #VALUE 3MARCH10 | |
| *5* | #TO CONFIRM 10 MIO AGREED AT 90.00 I SELL USD | |
| *6* | # MY JPY TO MARTINGALE TOKYO | |
| *7* | #THANKS AND BIBI | |
| *8* | TO CONFIRM AT 90.00 I BUY 10 MIO USD | |
| *9* | VALUE 3MARCH10 | |
| *10* | MY USD TO DIFFUSION BANK NY | |
| | THANKS AND BIBI | |
| | ENDED AT 0132GMT | |
| | *Explanation*<br>*Ballistic Trading is soliciting a quote from Martingale's NY desk.* | |
| | *Line 1 identifies this as a USD/JPY trade on $10 mio USD/JPY.* | |
| | *Line 2 is Martingale's quote in pips equal to 89.98/90.00 as the the "big figure" of 90 is understood.* | |
| | *Line 3 is Ballistic agreeing to buy the dollars at 90.00.* | |
| | *Line 4 confirms Martingale sells $10 mio USD/JPY at 90.00.* | |
| | *Lines 4–7 Margingale is confirming the trade and instructs Ballistic to deliver the yen to Martindale's Tokyo branch.* | |
| | *Lines 8–10 Ballistic confirms the trade details and instructs Martingale to deliver dollars to Diffusion Bank NY.* | |

**EXHIBIT 1.5** Sample Foreign Exchange Confirmation

**Martingale Bank**
Foreign Exchange Department
New York

March 1, 2010

Ballistic Trading, Inc.
Greenwich, CT
Account: 44-3309-2234

We confirm to you the following foreign exchange trade:

| | |
|---|---|
| Trade Number | 8660-071403 |
| Trade Date | March 1, 2010 |
| Value Date | March 3, 2010 |
| Exchange Rate | 90.00 |
| Currency We Sold | U.S. Dollar |
| Amount Sold | $10,000,000.00 |
| Currency We Purchased | Japanese Yen |
| Amount Purchased | ¥900,000,000.00 |

*If you have any question about this transaction or have reason to question its accuracy contact us at once.*
*This transaction is governened by a master trading agreeement signed by you and Martingale Bank.*



Bank for a quote for dollar/yen in the amount of $10 million—meaning Martingale's bid-ask quote on $10 million.

This conversation (between these fictional counterparties) is being conducted over an electronic dealing network. The upshot is that Ballistic buys $10 million against yen at 90.00. It is understood that this is a spot trade. Martingale would send Ballistic a written confirmation to memorialize the trade (Exhibit 1.5).

For large orders, say anything above $100 million in a major currency (but less than that in a minor currency), the dealer might inquire whether the order is the "full amount." If the party indicates that the order is indeed the full amount, it means that the indicated size will not be immediately followed by similar transactions of the customer's own initiation. Why would it matter to the dealer? The answer is that under usual circumstances, the dealer will seek to rebalance its dealing book once a customer order is filled. For example, if the customer buys $100 million against yen, then the dealing bank, having made short dollars, would immediately be in the market, buying dollars, using its reciprocal trading counterparties. The problem with

a nonfull amount order is that it could put the customer and the dealer in competition with each other in the after-market just as when the dealer is trying to reconstitute its book from the effect of the original customer transaction.

### Limit Orders and Stop-Loss Orders

Foreign exchange dealers accept limit orders and stop loss orders. A limit order gives a precise price at which a customer is willing to buy or sell foreign exchange. A stop loss order is a more complicated instruction. Stop loss orders are designed to liquidate bad trades in a timely manner so as to avoid steep losses. The trader who bought dollar/yen at 90.00 in the earlier example might have left instructions to "stop him out" at 88.00. This would mean that if the dollar were to trade at 88.00 or lower against the yen, the dealer would begin to sell the $10 million position as a market order. Banks accept stop loss orders only on a best-efforts basis. This means that there is never a guarantee that a stop loss order will be executed exactly at the stop level, in this case at 88.00.

The question becomes what happens if the dollar drops down to nearly 88.00. Stop orders present dealers with a chance to make some serious money if they are able to get the feel of the market correctly. Returning to the example, say that when dollar/yen was trading at 90.00, a customer gives a dealer a stop order to liquidate a position of long $10 million at 88.00. Suppose that the dollar falls to the 88.15 level. If the dealer has a good hunch that it will still go lower and trade at the 88.00 level, he, the dealer, will sell $10 million immediately for his own account in anticipation of being able to fill the customer's stop loss order later when 88.00 trades. If 88.00 does in fact trade, the dealer will have a profit of 15 pips, equal to the difference between where he sold dollars for his own account (at 88.15) and where he bought dollars (at 88.00) from the customer to fill the stop loss order. In reality, it will likely be a bit better than this for the dealer as the customer will almost certainly be filled below the level of the stop. But the whole trade is not without risk for the dealer. Consider that the dealer could have sold dollars at 88.15 only to see the dollar rebound upward, leaving him short dollars in a rising market and unable to fill the customer's stop loss order.

Knowledge of the placement of limit orders and stop loss orders, collectively called the order board, is valuable information for the dealer. One would hope this information would be kept completely confidential for the customer's sake. Sometimes the order board for a large dealer yields clues as to near-term movement of currencies. Stop loss orders can cause sudden, large movements in exchange rates, especially in cases where the market

runs past an important level where there are large quantities of stop loss orders. Nonetheless, despite all the problems, there is no getting around the need for stop loss orders.

In recent years, stop loss orders have become a larger factor in the foreign exchange market because of the growing popularity of exotic options. Exotic option risk management for dealers and customers often depends on efficient execution of stop loss orders.

### Direct Dealing, Brokers, and Electronic Trading

Foreign exchange dealers traditionally communicate with each other through computer messaging services, a facility that is called direct dealing. Each dealer has the ability to conduct a brief text conversation with counterparts at other dealing banks for the purpose of conducting foreign exchange trading. The actual text of a foreign exchange dealer conversation is usually highly abbreviated and assumes a close knowledge of market conditions.

Dealers make prices directly to other foreign exchange dealing banks but sometimes use the assistance of specialized foreign exchange brokers. Voice brokers work exclusively with the interbank market. They communicate with their client dealing banks via private direct phone lines and through computers. At all times, the job of the voice broker is to know who is making the highest bid and lowest ask for each currency. Brokers work their clients' orders in strict confidence, never revealing the name of a dealing bank until a trade has been completed. Brokers supply an important function in the foreign exchange market in that they collect and distribute price information.

In the 1990s, voice brokers began to have competition from electronic platforms such as the Electronic Broking System (EBS) and Reuters Matching 2000/2. According to the BOE (2009) survey, 18 percent of London market is done with voice brokers and 24 percent with electronic brokers. The NYFED (2009) survey showed 17 percent electronic broker and 20 percent voice broker trading.

Electronic broking is only one way that computers have changed the foreign exchange market. The most sophisticated dealing banks use computers to generate bid and ask quotations. "Auto-dealer" (the industry nickname) trades are usually sized in the small millions of dollars per ticket. The big trades remain the task of the flesh and blood traders, though. The auto-dealer process is not entirely robotic, as no sensible bank would let a machine run its dealing books without supervision and occasional intervention by humans. But the advantage of the auto dealer is that it can generate a more or less continuous stream of bid and ask prices.

The largest impact that computers have made is in the area of electronic trading. These platforms not only distribute bids and asks upon demand but allow clients to execute actual foreign exchange transactions online. Computerized trading and dealing has made the overall market deeper, faster, and less prone to dealing room errors. There are two main institutional varieties of electronic trading platforms. Multibank dealing systems[21] allow foreign exchange traders to compare and act on live bids and asks supplied by dealing banks. The second category consists of single-bank proprietary trading platforms.[22] This is the carriage trade of the foreign exchange market. Only a handful of the largest foreign exchange dealers have proprietary platforms, and those dealers make their platforms available only to select clients. On the other end of the spectrum are the retail foreign exchange companies[23] that focus on small speculative trading clients. Often these companies allow trading in currencies in smaller lots than the $1 million basic round lot size of the interbank market. These platforms are called foreign exchange aggregators because they combine odd-lot sized trades across their customer base, on one side, and lay off the positions in the round lots in the interbank electronic trading market.

The spread of electronic trading is one reason why the overall volume of foreign exchange trading has grown so large so fast. This was recognized in the BIS (2007) survey, where it was estimated that the median share of trades executed electronically in the interbank market was 34 percent. Electronic broking platforms were a particular success in Germany and Switzerland where they captured 55 percent and 44 percent, respectively, of all interbank trading. These shares rose to 67 percent and 58 percent for those countries when electronic trading was added to the mix. But in other countries, such as Belgium, the share was as low as 10 percent. The Bank of England (2009) survey found that 15 percent of all the London market volume was electronic trading. By contrast, the Federal Reserve Bank of New York (2009) survey found that 26 percent of New York trading was electronic.

All of these electronic trading platforms have allowed for the spread of what is sometimes called algorithmic (or just algo) trading. The term has been borrowed from electronic trading in the equity markets, but applications to the foreign exchange market are of a different nature. Some



[21]The Federal Reserve Bank of New York October 2009 survey gives examples of FXAll, Currenex, FXConnect, Globalink, and eSpeed.
[22]See King and Rime (2010).
[23]King and Rime (2010, page 39) cite examples of U.S.-headquartered FXCM, FX Dealer Direct, Gain Capital, and OANDA; European-based Saxo Bank and IG Markets; and Japanese-based Gaitame.com.

algorithmic trading is done on a high-frequency basis with the goal of stripping out what amounts to small profit opportunities—an example being pricing differentials between three exchange rates. Other methods are based on estimation of comovements in currency pairs. Another is rapid-fire execution triggered by computer analysis of macroeconomic data releases. Still others fit into the generic category of pattern recognition.

Electronic trading has greatly enhanced the price discovery process in foreign exchange. A consequence is a great narrowing of the width of the bid-ask spread, at least in cases of the major currencies. Gallardo and Heath (2009) present a graph of 22-day moving averages of bid-ask spreads (U.S. dollar per counterparty currency) of the EUR/USD, GBP/USD, JPY/USD, and AUD/USD for the period 1996–2008. Bid-ask spreads were in the vicinity of 4 to 5 pips for three of those currencies and around 8 pips for the AUD/USD in the period 1996–2001. Thereupon they began to fall, bottoming out at 2 to 3 pips for three of the currencies and 4 pips for AUD/USD. Interestingly, bid-ask spreads rocketed up following the Lehman crisis in September 2008 to the highest levels of the period in the Gallardo and Heath study, reaching over 8 pips for the three currencies and 12 pips for the AUD/USD.

Generally speaking, anything that reduces the cost of trading, deepens market liquidity, and brings new users to a market ought to be greeted with great enthusiasm. Electronic trading appears to have done all these things for the foreign exchange market. And the collateral benefit is a general cost reduction to the manufacturing of related instruments, such as all forms of options on foreign exchange. Still, electronic trading is not without controversy. But some commonly held thoughts about it may be unfounded. There is a worry that computer traders are absorbing market liquidity or that they create extra volatility. While it is true that electronic trading tends to hit the market in clusters over time, there is no evidence to date that it soaks up liquidity from the market. Moreover, at least one major study by economists at the Federal Reserve Board fails to find an association between volatility in exchange rate movements and electronic trading.[24]



## Settlement of Foreign Exchange Trades

Interbank spot foreign exchange transactions settle on value date with the physical exchange of sums of currencies. Every foreign exchange deal is a

[24]Chaboud (2009) writes: "Despite the apparent correlation of algorithmic trades, there is no evident causal relationship between algorithmic trading and increased exchange rate volatility. If anything, the presence of more algorithmic trading is associated with lower volatility" (p. 1).

cross-border transaction in the sense that settlement involves the transfer of bank deposits in two countries. Suppose Bank A buys 10 million euros against dollars from Bank B at the rate of 1.400. On value day, Bank A will receive ten million euros from Bank B perhaps in a Frankfurt account. On the same day, Bank B will receive 14 million dollars from Bank A perhaps in a New York account.

Switch back now to the previous example of the dollar/yen trade with my fictional Martingale Bank and its customer Ballistic Trading. Ballistic buys $10 million at 90.00 against yen (Exhibit 1.5 was my prototypical confirmation of this trade). Suppose this takes place in the New York morning trading session and by the afternoon, the dollar has risen. When the dollar is trading at the 91.00 level, Ballistic decides to liquidate the position to realize the profit. It solicits a quote and is told by Martingale that yen is now trading at 90.95/90.97. Ballistic immediately sells its dollars at 90.95.

Now Ballistic could settle the transaction and realize the profit in either dollars or yen. The initial transaction created a long position of $10 million and a short position of 900,000,000 yen. If Ballistic did the second transaction to sell exactly 10 million dollars, the profit would consist of the residual 9,500,000 yen. If Ballistic wanted the profit in dollars, it could tell the dealer to buy 900,000,000 yen at the dealer's price of 90.95. This would leave Ballistic with a profit equal to $104,453 (=9,500,000 yen/90.95).

But not all foreign exchange deals are settled with physical exchange of currencies, especially with nonbank customer trades. Some dealing banks offer their customers the convenience of settling on the basis of the net profit or loss on a deal. Using net settlement is also a way for a bank to do business in size with customers who do not ordinarily have strong enough balance sheets to support qualifying to make large foreign exchange settlements.



## INTEREST PARITY AND FORWARD FOREIGN EXCHANGE

### The Forward Outright

A forward exchange rate is a quotation for settlement or value at a date in the future beyond the spot value date. Forward rates can be negotiated for any valid future spot value date, but indications are usually given for one week, one month, three months, six months, and one year in the future. The Euromarket Day Finder (Exhibit 1.3) is the customary arbiter of what is a valid forward value date.

The forward exchange rate, called the outright, is usually quoted in two parts, one being the spot bid or ask, and the other a two-way quote

on forward points. Forward points are either added or subtracted from the spot rate to arrive at the forward outright.

Suppose that spot euro/dollar is quoted as 1.3998—1.4000 and that three-month forward points are quoted 0.0068—0.0070. Forward points are always quoted in foreign exchange pips. Forward points in this case are added to the spot level to obtain the three-month outright:

| Dealer's Bid | Dealer's Ask |
|---|---|
| 1.3998 | 1.4000 |
| +0.0068 | +0.0070 |
| 1.4066 | 1.4070 |

## Interest Parity

When the previous example was created, forward points for the euro happened to be positive because euro interest rates were below dollar interest rates. Had the euro interest rates been above dollar rates, the forward points would have been negative. This relationship between spot exchange rates, forward points, and interest rates is called the covered interest parity theorem. This theorem, which explains forward exchange rates, plays an important role in currency option theory.

The basic concept is that the market sets the forward outright in relation to spot in order to absorb the interest rate spread between two currencies. It is a no-free-lunch idea: One cannot hop between currencies, picking up yield advantage, and lock up a guaranteed profit by using the forward market to hedge against currency risk. The forward outright is the spoiler.

For example, suppose a euro-based investor were attracted by comparatively higher yields in U.S. dollar instruments. Suppose that the yield on 90-day euro paper is 4.00 percent, the yield on 90-day dollar paper is 6.00 percent, and that the spot euro/dollar is equal to 1.4000.

The investor might consider converting euros to dollars for the purpose of investing in high-yielding dollar paper. Parenthetically, this is the *raison d'être* for a whole host of strategies known as carry trades. The problem is that there is no way for the investor to capture some of the yield spread between the dollar and the euro without taking risk on the future direction of the spot exchange rate. If the dollar were to subsequently decline against the euro, some or all of the prospective yield pickup would be lost. If the dollar were to fall sufficiently, there might be a net capital loss on the transaction. On the other hand, if the dollar were to rise, the investor would make a profit to an extent greater than the indicated yield spread of 200 basis points.

Hedging cannot get around the problem. Consider that the investor might contemplate hedging the foreign exchange risk by selling dollars forward against the euro. The key question is what forward rate for euro/dollar would be available in the marketplace. The only forward rate that makes sense from an overall market perspective is 1.4069. Any other forward outright would imply riskless arbitrage would be possible. To see this, suppose that the investor were to start out with 1 million euros. If the investor buys 90-day euro paper, the sum would grow to 1,010,000 euros. On the other hand, if the investor converts the euros to dollars, the investor would receive $1,400,000. Invested for 90 days in dollar paper, the sum would grow to $1,421,000. The only arbitrage-free forward outright[25] is then

$$\frac{1{,}421{,}000}{1{,}010{,}000} = 1.4069$$

At this forward rate, the investor would be indifferent between dollar-denominated paper and euro-denominated paper on a fully hedged basis.

This concept is known as the covered interest parity theorem. It can be written either in terms of American or European convention:

*Interest Parity: American Convention*

$$F = S\frac{(1 + R_d)^{\tau}}{(1 + R_f)^{\tau}}$$

*Interest Parity: European Convention*

$$F' = S'\frac{(1 + R_f)^{\tau}}{(1 + R_d)^{\tau}}$$



where the current time is $t$ and the maturity date of the investment is $T$. The time remaining to maturity is denoted as $\tau$, which is equal to

$$\tau = (T - t)$$

$F$ is the forward rate quoted American convention for settlement at time $T$; $S$ is the spot rate quoted American; $R_d$ is the domestic interest rate, $R_f$ is the foreign interest rate. $F'$ and $S'$ are the forward and spot rates quoted European convention. Both the domestic and foreign interest rates are simple

[25]I am assuming a 360-day year, simple interest, and that the euros would be sold spot and bought forward both at the dealer's asking rate.

interest rates in this formulation, but a more useful mathematical form can be had from working in terms of continuously compounded rates:

*Interest Parity: American Convention*

$$F = Se^{(R_d - R_f)\tau}$$

*Interest Parity: European Convention*

$$F' = S'e^{(R_f - R_d)\tau}$$

## Specialized Forward Transactions

Dealers and other traders use the forward market to postpone or "roll" a maturing foreign exchange deal out on the calendar to a future value date. Two specialized forward transactions that accomplish this purpose are the spot/next and tom/next swap deals. These are examples of what I referred to previously as forward swaps. They are best understood in the context of an original spot foreign exchange deal. Suppose a trader buys 10 million euros against dollars spot at 1.1700. As I have described, spot transactions are for value in two bank business days.

Suppose that on the dealing day, the trader decides to extend the value date by one day. She could accomplish this by doing a spot/next swap transaction. A spot/next deal is actually a package of two trades that are bundled together. In the first part of the swap, the trader sells 10 million euros against dollars for normal spot value (hence the *spot*). Simultaneously, the trader buys 10 million euros against dollars for tomorrow's spot value date (hence the *next*). This accomplishes the stated goal of delaying settlement by one day because the settlement from the original spot deal crosses and is the opposite direction to the settlement in the first component of the spot/next swap. Some residual cash flows may yet occur on the original spot value date because of movements in the spot exchange rate between the time that the spot deal and when the spot/next roll is executed. Ordinarily this would be small in magnitude unless a violent movement in exchange rates has taken place.

Tom/next is practically the same thing as spot/next except that it is done on the day following the original spot deal (dealing date plus one day). Continuing with the example, in the *tom* part of the trade, the trader sells 10 million euros for dollars for value tomorrow. Tomorrow corresponds to the original deal's value date, which makes the settlement deliveries cross each other. The second part of the tom/next is a spot transaction to buy

10 million euros against dollars for the *next* value date—meaning the regular spot value date that occurs as usual in two bank business days.

Either way, using spot/next or tom/next, the trader in the example is able to maintain a long position in 10 million euro/dollar for one extra day without having to make physical delivery of the underlying sums of currency. Theoretically, the trader could continue to roll the value date using spot/next or tom/next transactions and keep the position on for an indefinite period of time. Alternatively, a trader could roll the position out for more than one day by doing a single swap transaction of spot against a forward outright for a specific term in the future. Squeezes in spot/next and tom/next are notorious, but not actually common in occurrence. Yet emerging market central banks have been known to engineer squeezes to flush speculators from taking or maintaining short positions in their currency.



## Non-deliverable Forward Transactions

Forward transactions can be done on a non-deliverable basis. In a non-deliverable forward (NDF), counterparties agree to settle a forward transaction with the payment of a settlement amount payable on a forward value date. *Fixing date* is defined as two bank business days before forward value date. In a popular arrangement, the *fixing rate* will be defined as the observed spot exchange rate posted by a central bank on the fixing date. Settlement amount is defined as

$$Settlement\ Amount = Notional - \left[\frac{Notional \times ForwardOutright}{Fixing\ Rate}\right]$$

where the notional amount is another term for the forward face amount.

Non-deliverable forwards are essential for trading in currencies that are not fully convertible because delivery of physical currency may not be feasible. Sometimes NDF markets spontaneously spring up in cases where a government suspends currency convertibility or enacts capital controls, as did Malaysia in 1997. The Bank of England's survey of the foreign exchange market as of October 2009 covers trading in NDF contracts in London. The bulk of trading is the U.S. dollar against the Brazilian real, South Korean won, Russian ruble, Chinese yuan, and Indian rupee. There are also a much smaller number of trades done against the euro, the pound Sterling, and other currencies. The survey estimates that $26.5 billion a day are done in the London NDF market.

## DEPARTURES FROM COVERED INTEREST PARITY IN 2007–2008

Covered interest parity is an arbitrage relationship that works well in normal market conditions. Taylor (1986) reached this conclusion in a carefully constructed empirical test of covered interest parity over a three-day period in November 1985. He collected contemporaneous data—by telephone conversations with dealers—at 10-minute intervals on GBP/USD and USD/DEM, observing spot, forward, and LIBOR deposit rates for 1-, 3-, 6-, and 12-month expirations. The results were a clear-cut affirmation of covered interest parity, meaning Taylor failed to find any evidence of profitable arbitrage.

Taylor (1989) did a second study that covered four other periods that he described as being times of market turbulence: the November 1967 Sterling devaluation, the June 1972 flotation of Sterling, the 1979 UK General Election, and the 1987 UK General Election. This time Taylor found evidence in at least some of the periods of profitable arbitrage opportunities. This was more the case in the earlier periods than the later ones, a finding that Taylor attributes to increases over time in the number of market participants and advances in information technology.

The finding that covered interest parity works in normal markets, Taylor's first study, but sometimes not in turbulent markets, his second study, is plainly echoed in the 2007–2008 period. This period was an exceptional time of financial crisis. Exhibit 1.6 was constructed with data from Bloomberg showing 3-month dollar LIBOR compared to the implied dollar interest rate extracted from the forward market for EUR/USD. Covered parity was working (as is normal) in 2006. But thereafter, as the crisis began to build, LIBOR rates were less than forward-implied rates. The climax of the crisis was in the middle of September 2008 when the investment banking firm of Lehman Brothers failed—here one can see forward implied LIBOR rates extending hundreds of basis points over LIBOR rates. Hui, Genberg, and Chung (2010) theorize that financial institutions, strapped for dollars, began to effectively borrow by doing massive forward swaps of foreign currency to get dollars.

This can be understood in the context of a huge surge in demand for dollar funding in the crisis period, dating from at least as early as the middle of 2007. Non-dollar-based institutions needing dollars apparently found it less costly to borrow in local currency in combination with doing forward swaps: They borrowed in local currency, then, in the first leg of the forward swap exchanged local currency for dollars on a spot basis, and finally, in the second leg of the forward swap simultaneously sold dollars forward for local currency. The excess demand for dollars showed up as the forward

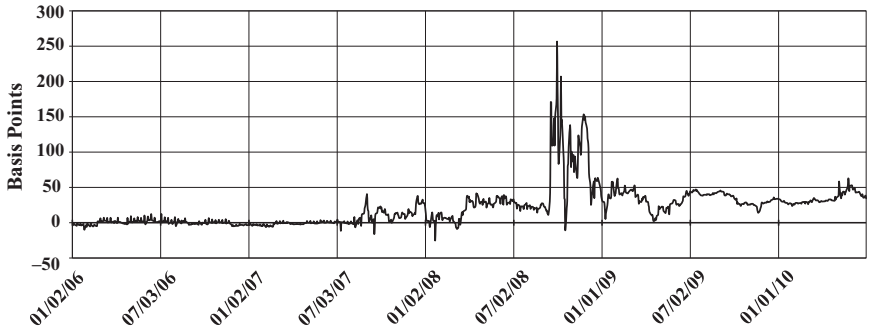


**EXHIBIT 1.6** Deviations from Covered Interest Parity
*Data source:* Bloomberg Finance L.P.

points being bid far away from what covered interest parity would have suggested.[26]

Numerically speaking 2007–2008 appears to be a plainly obvious violation of covered interest parity. Yet, despite what the historical data show, there may not have been a way to actually make money in trying to arbitrage LIBOR against the forward market. Trading lines became scarce as counterparties scaled down or even closed trading relationships because credit fears had gripped the marketplace. And it is here that Taylor (1989) defines what truly matters: "The essence of covered interest parity is that a true deviation from it represents a potential profit opportunity to a market trader at a point in time" (p. 429). In other words, the deviation from covered interest parity may not have been a true arbitrage opportunity, but rather an illusion of potential profit, in that there was no actual way to execute the suggested trade. But there may have been yet another reason. Observers of the 2008 crisis report that some banks may have been quoting LIBOR rates below actual market levels—by one theory banks feared quoting higher, correct, LIBOR rates would have created suspicion that they were either in trouble or were simply desperate for funds.[27] Either way, although there were measured deviations from covered interest parity in this extraordinary period, it is not clear that those anomalies constituted actual profit opportunities by Taylor's criterion.[28]



[26]See Baba, Packer, and Nagano (2008).
[27]See Finch and Gotkine (2008).
[28]There are well-known covered interest parity anomalies in China's RMB market, which Wang (2010) believes can be attributed to the presence of official capital controls.