CHAPTER 2

FOREIGN EXCHANGE: TRANSACTIONS IN SPOT, FORWARDS, SWAPS, FUTURES, AND OPTIONS

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Foreign-exchange transactions have become more and more important for importers, exporters, international and multinational corporations, and financial institutions as well as individuals. We review some basic concepts of the foreign-exchange market, explore the nature of various foreign-exchange transactions, and examine the properties of exchange-rate quotes and their relationships to each other. Finally, we discuss some of the risks involved in foreign-exchange transactions.

THE FOREIGN-EXCHANGE MARKET

Foreign exchange is foreign money in the form of notes and demand deposits. For obvious reasons, U.S. dollar-denominated notes and demand deposits are foreign exchange for residents outside the United States. British pound-denominated notes and demand deposits are foreign exchange for residents outside the United Kingdom.

In the foreign-exchange market participants exchange bank deposits denominated in one currency for bank deposits denominated in another currency. The exchange of bank notes constitutes only a very small fraction of total foreign-exchange market activities. As such, we ignore it here. The foreign-exchange market is primarily an over-the-counter market linked by telecommunication equipment such as telephones, telexes, and computers. Exchange-traded instruments such as futures and options, however, have been gaining market share. The market is the largest financial market in the world: average daily volume is estimated to be in excess of U.S. $250 billion.

The participants of the foreign-exchange market include individuals, international investors, importers and exporters, international corporations, financial institutions, and central banks. Financial institutions, primarily commercial banks, and, increasingly, other financial institutions, account for the large majority of all foreign-exchange transactions. The international money center banks execute orders for their customers and act as brokers. Most of these banks, though, see their main function as dealers/market makers. In their dealer role, banks make two-sided markets and are prepared to trade at any time with other market-making banks. Together, their foreign-exchange trading activities help to even out the temporary excesses of supply or demand that inevitably emerge from thousands of individual transactions executed each day.

Foreign-exchange transactions are executed by participants for a variety of purposes. Historically, most participants used the foreign-exchange market to finance some underlying commercial transaction, such as payment for imported goods. Recently, foreign-exchange transactions associated with capital-market operations—such as the issuance of debt abroad or the purchase of foreign financial assets—have surpassed transactions based on commercial activity. In addition, foreign-exchange transactions are used for hedging purposes. Hedging involves either the purchase or sale of foreign exchange to offset an exposed position or the deliberate assumption of an exchange risk in an effort to offset a similar risk in the opposite direction. Arbitrage transactions are usually executed by financial institutions. Foreign-exchange arbitrage describes activities that lead to profits from pricing ineffi-

ciencies in the market. These activities are, by definition, riskless only with respect to changes in exchange rates. As in any other market, speculative activities are an important component of foreign-exchange transactions. Speculation involves the intentional assumption of foreign-exchange risk (in the form of a long or short position) with the objective of generating profits from anticipated changes in exchange rates. Interventions by central banks are at times a very important component of foreign-exchange transactions. Central banks buy and sell foreign exchange to influence general money-market conditions, the level of exchange rates, and the volatility of exchange rates. Any intervention in the domestic money market affects the foreign-exchange market.

FOREIGN-EXCHANGE TRANSACTIONS

Foreign-exchange transactions involve the exchange of two currencies. When the deal has been agreed upon, the involved participants arrange for settlement. Settlement takes place in the two countries whose currencies are being used. In a transaction involving U.S. dollars and German marks, settlement is accomplished by payment of German marks in West Germany against payment of U.S. dollars in the United States. The currencies are actually delivered as debits and credits. The dealing center, that is, the place in which the deal is made, has to be distinguished from the settlement centers.

Spot Transactions

The most common transaction in the interbank market is a spot transaction.

Settlement

By convention, the agreed payment date, or "value date" as it is known, is two business days after the day the transaction is originated. The reasons for this custom are practical and administrative. The foreign-exchange market must overcome time differences of up to 24 hours. Therefore, a standard spot value date of either the same day (today) or the next business day (tomorrow) would be infeasible in most cases.

To be an eligible value date, the settlement date must be a business day in the countries of the currencies being traded. The same holds for the definition of a business/working day. Because of time-zone differences, settlement on any given working day will first be accomplished in the Far East, then in Europe, and lastly in the United States.

There are several exceptions to the two business days settlement rule:

1. If a foreign-exchange spot transaction involves the U.S. dollar and the first of the two days is a holiday in the United States but not in the other settlement center, the first day is counted as a business day for settlement purposes.
2. Spot transactions involving the Canadian dollar and Mexican peso versus the U.S. dollar are settled one business day after the transaction is originated.
3. Fridays are not part of the business week in most Middle Eastern countries, though Saturdays and Sundays are. For a typical spot transaction originating on Wednesday, the settlement for the non-Middle Eastern currency would occur on Friday while the Middle Eastern currency settles on Saturday.

Spot Rate Definition. The spot rate is the price at which spot transactions are facilitated in the interbank market. In general, all quotations are only good for immediate dealing. At times, a specific spot quote given by a bank indicates whether the bank wants to increase or reduce its position in a particular currency. For example, if a bank owns more Swiss francs than it believes to be optimal, the bank sets its quote to discourage sellers of Swiss francs and encourage buyers of Swiss francs.

Quotation. With the exception of the British pound and some related currencies such as the Australian and New Zealand dollars, exchange rates are expressed in direct quotes in the interbank market. Direct (European) quotes express exchange rates as the amount of domestic (non-U.S.) currency units per foreign currency unit. Usually, the foreign currency unit is the U.S. dollar. For direct quotes, the domestic (non-U.S.) currency is

called the quoted currency and the foreign currency is the base currency. Depending on the value of the domestic currency relative to the foreign currency, direct quotes have been between zero and six decimal places. Typical direct quotes are

DM 2.2110/$
Can$ 1.3760/$

The British pound and related currencies are always expressed in indirect quotes. Indirect (American) quotes express exchange rates as the amount of foreign currency units per domestic currency unit. Historical reasons account for expressing the value of the British pound in indirect quotes. Until World War I, and to a certain extent also between the world wars, the British pound was the cornerstone of the international monetary system. All countries expressed the value of their respective currencies vis-à-vis the British pound. As the political, economic, and financial power moved from London to New York, countries started to express the value of their currencies in terms of the U.S. dollar. However, the tradition for quoting the British pound was not altered. In addition, the British pound remained a nondecimal currency until the early 1970s. A direct quotation for the British pound would have been extremely awkward. Typical indirect quotes (for non-Americans) are

$ .4523/DM
$ .7267/Can$

Obviously, direct quotes and indirect quotes are not independent from each other. The relationship between them is reciprocal: 2.2110 is approximately the reciprocal of .4523 ($1 \div 2.2110 \simeq .4523$). A direct DM/$ quote for a German trader is an indirect quote for an American trader. The following table illustrates this:

	Direct Quote	*Indirect Quote*
German:	DM 2.2110/$	$ .4523/DM
American:	$ .4523/DM	DM 2.2110/$
Canadian:	Can$ 1.3760/$	$ .7267/Can$
American:	$ .7267/Can$	Can$ 1.3760/$
British:	—	$ 1.4275/£
American:	$ 1.4275/£	—

Cross Rates. The general practice of the foreign-exchange market is to quote the value of any currency with respect to the U.S. dollar. Once the rates for two currencies, such as the German mark and the Canadian dollar, are known in terms of the U.S. dollar, the price of the German mark in terms of the Canadian dollar as well as the price of Canadian dollar in terms of the German mark can be calculated. An exchange rate that is calculated based on two other exchange rates is called a cross rate. For the example cited earlier, the following holds:

$$\text{DM/Can\$} = \frac{\text{DM/\$}}{\text{Can\$/\$}}$$

$$\text{Can\$/DM} = \frac{\text{Can\$/\$}}{\text{DM/\$}}$$

Given the spot rates of DM 2.2110/$ and Can$ 1.3760/$, we can calculate the following direct quotes:

$$\text{Germany: } \frac{\text{DM } 2.110/\$}{\text{Can\$ } 1.3760/\$} = \text{DM } 1.6068/\text{Can\$}$$

$$\text{Canada: } \frac{\text{Can\$ } 1.3760/\$}{\text{DM } 2.2110/\$} = \text{Can\$ } .6223/\text{DM}$$

Following European custom, these quotes are expressed as DM 160.68/Can$ 100 and Can$ 62.23/DM 100. Cross-rate quotes are given for 100 units of the foreign currency. This practice reduces the number of decimal places used in the quotation. With spot rates of DM 2.2110/$, Can$ 1.3760/$, and $ 1.4275/£ the following cross rates can be calculated:

	Direct Quotes	*Indirect Quotes*
Germany	DM 160.68/Can$ 100	Can$ 62.23/DM 100
Canada	Can$ 62.23/DM 100	DM 160.68/Can$ 100
Germany	DM 315.62/£ 100	—
Britain	—	DM 315.62/£ 100
Canada	Can$ 196.42/£ 100	—
Britain	—	Can$ 196.42/£ 100

Exchange-Rate Changes. Because of the floating exchange-rate system, exchange rates, just like other asset prices, change continuously. Suppose the DM/$ rate changes from DM 2.2110/$ to DM 2.1850/$. For any exchange-rate quote, a decrease (increase) of the numerical value of the quote indicates an increase (decrease) in the value, that is, an *appreciation* (*depreciation*) of the quoted currency. An appreciation of the quoted currency automatically implies a depreciation of the base currency.

Changes in the exchange rates are often expressed as indicated earlier. They are also expressed in basis-point changes, changes in ticks, and percentage appreciations or depreciations.

A basis point refers to the last digit in a European (direct) quote used in the interbank market. A change in the DM/$ rate from DM 2.2110/$ to DM 2.1850/$ is a 260 basis-point decrease of the spot rate. (2.1850 − 2.2110 = −.0260 = −260 basis points).

A tick refers to the last digit in an American quote. In the preceding example, the change of the quotes from Dm 2.2110/$ to DM 2.1850/$ corresponds to a change of the American quotes from $ .4523/DM to $ .4577/DM. This is a 54-tick increase in the exchange rate. (.4577 − .4523 = .0054 = 54 ticks).

Changes in exchange rates are often expressed in percentage appreciations and depreciations. If the German mark appreciates against the U.S. dollar, the U.S. dollar depreciates against the German mark. However, the percentages of appreciations and depreciations are not identical. For small exchange-rate changes these differences can be ignored. The following calculations demonstrate this point:

	DM/$	*$/DM*
Ending Rate (a)	2.1850	.4577
Starting Rate (b)	2.2110	.4523
Difference (a) − (b)	−.0260	+.0054
Percentage change: $\frac{(a)-(b)}{(b)} \times 100$	$\frac{-.0260}{2.2110} \times 100$	$\frac{.0054}{.4523} \times 100$
Result	−1.176%	+1.194%

The results indicate that the U.S. dollar depreciated against the German mark by 1.176 percent, whereas the German mark appreciated against the U.S. dollar by 1.194 percent. Notice also that the percentage appreciation of one currency always has to be larger than the percentage depreciation of the other currency.

Bid-Ask Spreads. Typically, a bank quotes two-way prices: the price at which it will buy (bid) and the price at which it will sell (ask/offer). Regardless of the terms used in the quote, a match with a bank's quotation can be arranged only if another party does exactly the opposite of what the bank is doing. The size of bid-ask spreads depends on the currencies involved, their volatilities, the time of day, and the liquidity in the market. The more uncertainty and the less the liquidity, the larger the bid-ask spread. Spreads reimburse banks for their costs and risks incurred in their foreign-exchange transactions. Typical spreads in the spot market for DM/$ and Can$/$ quotes are

DM: 2.2107/13
Can$: 1.3760/65

If a bank is quoting the preceding figures, this means that a customer can buy German marks from (sell U.S. dollar to) the bank at DM 2.2107/$ and can sell German marks to (buy U.S. dollars from) the bank at DM 2.2113/$. At the same time, the bank sells German marks (buys U.S. dollars) at DM 2.2107/$ and buys German marks (sells U.S. dollars) at DM 2.2113/$. The conventional quotation needs explaining when the "big figure" is being straddled. A quote of DM 2.2195/05 is to be interpreted as: bid 2.2195, ask 2.2205.

As explained earlier, spreads reimburse banks for their costs and risks. A bank's income for a $1 million round-trip transaction can easily be computed. The bank has to pay DM 2,210,700 for $1 million. It receives DM 2,211,300 for selling $1 million. Total profits equal DM 600, or roughly $271.37 (converted at the mid-point of bid/ask spread). The percentage transaction cost can be directly calculated using the following formula:

$$\text{Percentage transaction cost: (round trip)} \quad \frac{(\text{Ask} - \text{Bid}) \times 100}{(\text{Bid} + \text{Ask}) / 2}$$

Given bid/ask quotes for DM/$ and Can$/$ transactions, the bid/ask prices for the cross-rate quote of DM/Can$ (or Can$/DM) can be calculated:

	DM/$	*Can$/$*
Bid	2.2107	1.3760
Ask	2.2113	1.3765

DM/Can$ bid: 2.2107/1.3765 = DM 160.60/Can$ 100
DM/Can$ ask: 2.2113/1.3760 = DM 160.70/Can$ 100

To buy Canadian dollars, a German participant first buys U.S. dollars in exchange for German marks, and then sells U.S. dollars in exchange for Canadian dollars. To sell Canadian dollars, a German participant first sells Canadian dollars in exchange for U.S. dollars and then sells U.S. dollars in exchange for German marks.

Correspondingly, the calculation for Can$/DM quotes is

Can$/DM bid: 1.3760/2.2113 = Can$ 62.23/DM 100
Can$/DM ask: 1.3765/2.2107 = Can$ 62.27/DM 100

In general, given two quotes (A and B) the following formula for cross-rate spreads applies:

$$\text{cross-rate spread (\%)} = (1 + \text{spread A(\%)})\,(1 + \text{spread B(\%)}) - 1$$

Spreads for quotations of currencies that trade on a continuous basis are much narrower than those of currencies traded infrequently or in smaller volume. Whether the use of a cross-rate is more advantageous than using the U.S. dollar depends on the size of available spreads. In general, coping with one spread rather than two is preferable. However, some of the crosses are traded infrequently. It is therefore possible that the cross-rate spread is larger than the sum of the spreads in the two quotes against the U.S. dollar.

A customer should always shop for the best quotes available. Typically, a customer calls at least 3 and no more than 10 dealers to get the best available quote. For the multitude of currencies traded,

the speed of quotations, the size of transactions, as well as narrow spreads and constant liquidity are the prime selection criteria for choosing the right partner in foreign-exchange transactions.

Forward Outrights

A forward-outright transaction differs from a spot transaction in that the value (settlement) date is more than two business days in the future. The maturity of a forward contract can be a few days, months, or even years. Maturities of exactly one week, one month, or two months are called even dates. All other maturities are odd dates. Active trading in the interbank market is ordinarily limited to even-date maturities. Trading for odd dates is primarily between banks and their customers. Forward contracts with settlement dates identical to currency futures and options contracts are also considered even-date contracts and are actively traded in the interbank market.

A forward contract is an agreement to exchange a specified amount of foreign currency at a future date. The exchange rate is fixed at the time the forward contract is agreed. No accounts are debited or credited until settlement date.

Settlement

Generally, the settlement date for any forward contract is determined according to the following: first, one finds the proper spot value date for the specific currencies in the foreign-exchange market.

Second, if the spot value date is, for example, October 3, the one-day forward contract settles October 4, the one-week contract on October 10, the one-month contract on November 3, and the two-month contract on December 3. A full calendar month is used, regardless of the number of days in that particular month.

Third, if the settlement date determined is a holiday in either or both settlement centers, the next eligible business day (going forward rule) will be the settlement date.

Fourth, if the going-forward rule carries over into the next week, month, or year, the rule of going forward to the next eligible day does not apply. Instead, the eligible date is determined by the

going-backward rule. Thus, settlement will be on the last eligible date in the particular week, month, or year.

The last business date of a month is particularly important in financial markets due to many standard payments occurring on that day. If these payments are denominated in foreign currencies, firms might want to hedge the associated foreign-exchange exposure. In this sense, the last business day of a month, quarter, and year is an often-used, standard forward value date.

Forward Rate

Definition. The forward rate is the price at which forward transactions are facilitated in the interbank market. There is a unique forward rate for each maturity date. As for spot quotes, forward quotes are only good for immediate dealing. Transaction costs, that is, bid-ask spreads associated with forward contracts, are larger than those on spot transactions. Moreover, the spreads tend to increase with the length of a forward contract as well as the volatility of the currencies involved.

Quotation. Forward exchange rates can be quoted in three distinct ways. The comments made on spot-rate quotes concerning direct/indirect quotes, quoted/base currencies, basis points/ticks, spreads, and cross rates apply equally to forward exchange rates. Bank traders normally quote forward rates as outright quotes to corporate customers and correspondent banks seeking to buy or sell a currency for a particular future date. Outright quotes are either in the form of direct quotes or indirect quotes. The following table shows direct and indirect quotes for rates of the German mark and Canadian dollar against the U.S. dollar:

	Direct DM/$	*Indirect $/DM*	*Direct Can$/$*	*Indirect $/Can$*
Spot	2.2107/13	.4522/24	1.3760/65	.7264/67
1 month	2.2055/63	.4532/35	1.3776/83	.7255/59
2 months	2.2016/24	.4540/43	1.3791/99	.7246/51
3 months	2.1973/81	.4549/52	1.3809/19	.7236/42
6 months	2.1837/48	.4577/81	1.3868/78	.7205/11
12 months	2.1574/90	.4631/37	1.3982/02	.7141/52

In the interbank market, banks quote forward rates in basis point or tick differences to the spot rate (swap rates or points). The swap rates for the direct and indirect outright quotes in the preceding table are as follows:

	Direct DM/$	*Indirect $/DM*	*Direct Can$/$*	*Indirect $/Can$*
Spot	2.2107/13	.4522/24	1.3760/65	.7264/67
1 month	52/50	10/11	16/18	9/8
2 months	91/89	18/19	31/34	18/16
3 months	134/132	27/28	49/52	28/25
6 months	270/265	55/57	108/113	59/56
12 months	533/523	109/113	222/237	123/115

Several things should be noted. First, the swap rates are not exchange rates but exchange-rate differentials. Second, swap rates ignore the appropriate place of the decimal point in relation to the spot rate. In general, the last digit of a swap rate corresponds to the last digit in the corresponding spot rate. Third, because swap rates are exchange-rate differentials, simply taking the reciprocal of swap rates does not enable one to go from direct to indirect quotes and vice versa. Fourth, all swap-rate quotes are positive numbers.

Fifth, in the preceding example bid quotes are larger than ask quotes for DM/$ and $/Can$ quotes and smaller for $/DM and Can$/$ quotes. This distinction determines whether swap rates have to be added to or subtracted from the current spot rate to determine the forward-outright quote. Independent of whether direct or indirect quotes are used, the following rules apply: If the swap-rate bid is greater than the ask quote, the swap rate has to be subtracted from the current spot rate to determine the forward-outright quote. For a dealer to make money, the bid rate has to be always lower than the offer rate. If the swap points are quoted such that the left side is larger than the right side and if the swap points are added to the spot rate, then there is the possibility that the calculated forward-outright bid is greater than the forward-outright ask. Because this should not happen, the swap points have to be subtracted from the spot rate. If the swap-rate bid is smaller than the ask quote, the swap rate has to be added to the current spot rate to determine the forward-outright quote. These rules are demonstrated for the DM/$ and $/DM quotes as follows:

DM/$

	Bid	*Ask*
Spot	2.2107	2.2113
1 month	2.2107 − .0052 = 2.2055	2.2113 − .0050 = 2.2063
2 months	2.2107 − .0091 = 2.2016	2.2113 − .0089 = 2.2024
3 months	2.2107 − .0134 = 2.1973	2.2113 − .0132 = 2.1981
6 months	2.2107 − .0270 = 2.1837	2.2113 − .0265 = 2.1848
12 months	2.2107 − .0533 = 2.1574	2.2113 − .0523 = 2.1590

$/DM

	Bid	*Ask*
Spot	.4522	.4524
1 month	.4522 + .0010 = .4532	.4524 + .0011 = .4535
2 months	.4522 + .0018 = .4540	.4524 + .0019 = .4543
3 months	.4522 + .0027 = .4549	.4524 + .0028 = .4552
6 months	.4522 + .0055 = .4577	.4524 + .0057 = .4581
12 months	.4522 + .0109 = .4631	.4524 + .0113 = .4637

At times, the middle rate for a currency in the forward market is identical to the middle rate available in the spot market. This means that the forward price is at par with the spot price. The swap rate might then be expressed as −7/+7 or 7P7. This means that the quoting bank is willing to buy forward at a seven-point discount to spot and willing to sell at a seven-point premium to spot. Equally, a quote of 14/00 or 14/P shows that the quoting bank is willing to buy the forward at a 14-point discount and willing to sell at par with spot.

The third way to quote forward rates is in annualized forward premiums or discounts. If a currency is less (more) expensive in the forward market than in the spot market, the currency is said to be trading at a forward discount (premium).

Forward premiums and discounts can be calculated only with respect to the base currency. That means that in DM/$ quotes, the forward premium or discount of the U.S. dollar vis-à-vis the German mark can be calculated. In $/DM quotes, the forward premium or discount of the German mark vis-à-vis the U.S. dollar is calculated.

To use a common denominator, premiums and discounts are annualized. For this, the Euromarkets use two bases: a 360-day year or a 365-day year. The 365-day year is used for the British

pound, the Irish pound, the Kuwaiti dinar, and the Belgian franc. All other currencies are dealt on a 360-day basis. The Belgian franc is also dealt on a 360-day year if both parties involved are non-Belgian. At times, banks in their dealings with customers use a 365-day year for the Canadian dollar though interbank dealings are on the basis of 360 days.

Premiums and discounts can be calculated with respect to the current spot or the forward-outright rate. Views regarding the correct approach differ. The choice should depend on the particular transaction. It often is suggested that if a forward contract is used to hedge a forward commitment, the forward rate should be used as the base. If, however, a forward contract is used to hedge a current foreign-currency-denominated investment, the spot rate should be used as the base. Premiums and discounts in interbank market transactions are usually calculated on the base of the forward rate. The formula for the calculation of annualized premiums/discounts (AP/D) is:

$$\text{AP/D} = \frac{\text{Forward Outright} - \text{Spot}}{\text{Spot or Forward Outright}} \times \frac{360 \text{ or } 365}{n} \times 100$$

where n is the length of the forward contract in days.

Premiums and discounts can be calculated using bid or ask prices or the middle rates. The following tables show the calculation for annualized premiums and discounts for DM/$ and Can$/$ quotes using a 360-day year, bid prices, and the spot rate as the base:

DM/$

1 month	$\text{AP/D} = \frac{2.2055 - 2.2107}{2.2107} \times \frac{360}{30} \times 100 = -2.8225\%$
2 months	$\text{AP/D} = \frac{2.2016 - 2.2107}{2.2107} \times \frac{360}{60} \times 100 = -2.4698\%$
3 months	$\text{AP/D} = \frac{2.1973 - 2.2107}{2.2107} \times \frac{360}{90} \times 100 = -2.4246\%$
6 months	$\text{AP/D} = \frac{2.1837 - 2.2107}{2.2107} \times \frac{360}{180} \times 100 = -2.4427\%$
12 months	$\text{AP/D} = \frac{2.1574 - 2.2107}{2.2107} \times \frac{360}{360} \times 100 = -2.4110\%$

	Can$/$
1 month	$AP/D = \frac{1.3776 - 1.3760}{1.3760} \times \frac{360}{30} \times 100 = +1.3952\%$
2 months	$AP/D = \frac{1.3791 - 1.3760}{1.3760} \times \frac{360}{60} \times 100 = +1.3517\%$
3 months	$AP/D = \frac{1.3809 - 1.3760}{1.3760} \times \frac{360}{90} \times 100 = +1.4244\%$
6 months	$AP/D = \frac{1.3868 - 1.3760}{1.3760} \times \frac{360}{180} \times 100 = +1.5698\%$
12 months	$AP/D = \frac{1.3982 - 1.3760}{1.3760} \times \frac{360}{360} \times 100 = +1.6134\%$

The results indicate that the U.S. dollar trades at a forward discount against the German mark, whereas it trades at a forward premium against the Canadian dollar. As explained later, a currency trades at a forward premium (discount) against another currency if its money-market rate is lower (higher) than the corresponding money-market rate of the other currency. Typically, interest rates on DM-denominated deposits are lower than corresponding interest rates on U.S.-dollar-denominated deposits. Interest rates on Canadian-dollar-denominated deposits are higher than those on U.S.-dollar-denominated deposits. Hence with respect to the U.S. dollar, the German mark is typically trading at a forward premium while the Canadian dollar is trading at a forward discount.

Forwards (Classical Swaps)

Banks active in the interbank market find trading forward-outright contracts relatively risky. Consequently, they use them infrequently. Instead, banks trade in the interbank market on the basis of a transaction known as a swap. This swap is a different transaction from the more recently introduced capital-market cross-currency swap, which we discuss in a later section.

A swap transaction involves the simultaneous purchase and sale of a certain amount of foreign currency for two different value dates. In a swap position, the amount of the foreign currency

bought always equals the amount of the same foreign currency sold. Only delivery dates for the purchase and sale differ. There are basically four swaps:

1. The purchase of spot against the sale of forward.
2. The sale of spot against the purchase of forward.
3. The purchase of short-term forward against the sale of longer-term forward (forward-forward swap).
4. The sale of short-term forward against the purchase of longer-term forward (forward-forward swap).

A swap transaction does not create a foreign-exchange exposure. It does, however, create an interest-rate exposure as participants effectively borrow one currency and lend the other. A change in relative interest rates during the life of the swap thus influences profits and losses.

A swap transaction can be either a pure swap or an engineered swap. A pure swap is arranged as a single transaction with a single counterparty. An engineered swap is arranged in two transactions with two different counterparties. Because the two transactions of an engineered swap might be closed at different times, both the spot rate and the swap rate are of importance.

Banks engage in swap transactions for three major purposes:

1. To change the currency denomination of a transaction from one currency to another and back again.
2. To move a given currency deal forward or backward in time.
3. To take views on changes in interest rates as a component of their overall trading or global funding strategy.

As an example for the first use, assume that a bank is unable to lend a particular currency. The bank borrows another currency, sells that currency spot against the needed currency, and simultaneously sells the latter currency forward. Through swap transactions, banks can produce or manufacture any desired currency.

As an example for the second use, assume that a bank sold forward outright a currency to its corporate client. The bank could hedge its exposure by buying the currency forward in the interbank market. Because of the (credit) risks involved, interbank forward-

outright deals are rare. Instead, the bank buys the currency spot and then uses a swap transaction which sells the currency spot and buys it forward. The swap market helps to shift the forward exposure to a nearer date.

Banks also use swap transactions to profit from anticipated changes in interest differentials. Suppose, for example, a bank expects the foreign interest rate to decline within a month. The decline in the foreign interest rate might lead to an appreciation or depreciation of the foreign currency. To speculate on either would be risky. But the reduction in the foreign interest rate will surely increase the forward premium (or reduce the forward discount). The bank, therefore, expects to be able to sell the foreign currency at a higher premium (lower discount) in a month. The bank enters into a swap transaction selling the foreign currency spot and buying it forward. If the change in interest rates occurs, the bank reverses the swap for a profit.

Corporations also use the swap market for the preceding reasons. In addition, they enter swap arrangements to alter maturity dates of previous obligations. Assume, for instance, a company bought forward foreign exchange to cover an account payable due in six months. Five months later it becomes obvious that the payment is not due for another three months. The corporation enters into a swap agreement selling one-month forward and buying three-months forward the foreign currency (forward-forward swap).

By definition, a swap transaction implies a zero net foreign-exchange position. However, the maturity of various cash flows may not be matched. If interest-rate differentials are fully reflected in forward premiums and discounts, a swap transaction with matched cash flows does not generate profits. The profits are derived from deliberately mismatching cash flows in anticipation of changes in interest-rate differentials. To lock in profits (or limit losses) after a change in an interest-rate differential has occurred, banks usually square the cash flow positions.

Settlement

Settlement dates for either leg of swap positions are determined according to the rules for spot and forward settlement dates.

Swap Rate Definition. The swap rate is the price at which swap transactions are facilitated in the interbank market. There is a unique swap rate for each maturity structure of the two components. This implies that the spot-three month swap rate usually differs from the three to six month swap. As stated earlier, the swap rate is not an exchange rate but an exchange-rate differential, that is, the difference between the rates of exchange used in the two trades. For most practical purposes, the level of the spot rate itself is not very important. What matters are the premiums and discounts to spot received or paid.

To the extent that time elapses between the initial swap with unmatched cash flows and the one generated to square the cash flows, changes in the spot rate may have a significant influence on the level of the swap rate. (A 3 percent interest differential between the German mark and the U.S. dollar gives a swap rate of 600 points at a spot-rate level of DM 2.0000/$. The same interest differential gives a swap rate of 900 points at a spot-rate level of DM 3.0000/$.)

Quotation. Swap rates are quoted in two distinct forms. The previous comments made on spot and forward quotes apply equally to swap rates. Swap rates are most often quoted in basis-point differentials. We discussed the mechanics in the previous section. Suppose, the current DM/$ and Can$/$ quotes are as follows:

	DM/$	*Can$/$*
Spot	2.2107/13	1.3760/65
1 month	52/50	16/18
2 months	91/89	31/34
3 months	134/132	49/52
6 months	270/265	108/113
12 months	533/523	222/237

The spot-six month DM/$ swap rate of 270/265 means the bank is prepared to swap out German marks (sell German marks spot, buy German marks forward) at a cost of 265 basis points. The

bank is willing to swap in German marks (buy German marks spot, sell German marks forward) at a net benefit of 270 basis points. The corresponding quote for a 6–12 month forward-forward swap is 263/258. (533 − 270 = 263; 523 − 265 = 258).

The spot-six month Can$/$ swap rate of 108/113 means the bank is prepared to swap out Canadian dollars at a net benefit of 113 basis points. The bank is also willing to swap in Canadian dollars at a cost of 108 basis points. The corresponding quote for a 2–12 month forward-forward swap is 191/203 (222 − 31 = 191; 237 − 34 = 203).

The second way of quoting swap rates is in equivalent annualized interest-rate differentials. This is done because in a swap transaction a bank is effectively borrowing one currency and lending another currency for the period between the two value dates. The calculation is based on the following (simplified) formula:

$$\text{Swap Rate (\%)} \frac{\text{Swap Rate}}{\text{Spot Rate (or Forward Rate)}} \times \frac{360 \text{ or } 365}{n} \times 100$$

where n is the number of days in the swap.

Using the preceding rates for a spot-six month swap and the spot rate as a base, the following results can be calculated:

DM/$ bid:

$$\text{Swap rate (\%)} = \frac{.0270}{2.2107} \times \frac{360}{180} \times 100 = 2.443\%$$

DM/$ ask:

$$\text{Swap rate (\%)} = \frac{.0265}{2.2113} \times \frac{360}{180} \times 100 = 2.397\%$$

Can$/$ bid:

$$\text{Swap rate (\%)} = \frac{.0108}{1.3760} \times \frac{360}{180} \times 100 = 1.570\%$$

Can$/$ ask:

$$\text{Swap rate (\%)} = \frac{.0113}{1.3765} \times \frac{360}{180} \times 100 = 1.642\%$$

The quoting bank is willing to swap out German marks (Canadian dollars) at a net cost (yield) of 2.397 percent (1.642 percent). It is willing to swap in German marks (Canadian dollars) at a net yield (cost) of 2.443 percent (1.570 percent).

Short Dates

Short-date forward contracts are defined in numerous ways. They are foreign-exchange transactions with maturities less than a month, or with maturities less than a week; or transactions with maturities before spot. In this section, transactions with value dates before spot are covered.

Spot-value dates are normally two business days after the transaction is agreed upon. This leaves some room for deals with value dates before spot, such as value date today and value date tomorrow (next business day). Because of existing time-zone differences among the major dealing centers, deals with value dates before spot are often not feasible. Deals for value today can only be done for currencies whose settlement time zones are substantially behind the time zone of the dealing center. For example, a Canadian dollar/U.S. dollar or even a German mark/U.S. dollar deal struck in Tokyo could be done for value today. The time-zone difference in this example is sufficient to process all the necessary documentation for settlement. On the other hand, a Japanese yen/U.S. dollar deal struck in New York could not be done for value today. Foreign-exchange transactions for value tomorrow (next business day) are more often possible than for value today. Subject to these constraints, foreign-exchange transactions with value dates before spot are possible for certain currencies and certain countries.

In the interbank market, most of the short-date transactions are done in the form of swap agreements. These swaps include, from today until tomorrow (overnight or O/N), and from tomorrow until the next business day (tom/next). The tom/next swap is often referred to as the "rollover swap" in the United States. Depending on the definition for short dates, other swap transactions such as spot/next, spot a week, spot a month can be included.

Short-date swaps are primarily used for swapping out of overbought or oversold positions. For example, an overbought position in pound sterling for spot delivery can be dealt with in two ways. The bank can move spot delivery backwards with a tomorrow/next swap transaction. In this case, the bank would buy the foreign currency for value date tomorrow and sell it for spot. The bank can also move the spot delivery forward with a spot/next

swap transaction. Here the bank sells pound sterling for spot and buys it forward for settlement of the first business day after spot.

Settlement

Settlement dates for short-date transactions are implied by their names. Depending on the particular swap transaction the value dates are either today, the next business day after today (tomorrow), the spot-value date, or any day after spot. The value dates after spot are determined the same way as settlement dates for forward contracts.

Swap Rate

Quotation. Short-date swaps work just like every other swap. However, these swap rates have to be used differently as they are used to calculate forward-outright (better: backward-outright) rates before spot. Assume the following spot and swap rates for German mark/U.S. dollar transactions:

	DM/$
Spot	2.2107/13
O/N	11/7
T/N	5/3
1 month	52/50

Suppose the spot delivery date is Thursday and the current (Tuesday) spot rate is 2.2107/13. The outright rate for Tuesday and Wednesday delivery—rates before spot—have to be calculated. The swap rates have to be worked backwards in time to a date before spot. This does not mean that instead of subtracting swap rates (if bid is larger than offer) they are now added to spot rate. It means that bid/ask swap rates are switched and then added to or subtracted from the spot rate according to the general rules. The following table describes the procedure:

	Quotes	*Reversal*	*Calculation*	*Outright*
Spot	2.2107/13			2.2107/13
O/N	11/7	7/11	bid 2.2107 + .0007 = 2.2114 ask 2.2113 + .0011 = 2.2124	2.2114/24
T/N	5/3	3/5	bid 2.2107 + .0003 = 2.2110 ask 2.2113 + .0005 = 2.2118	2.2110/18
1 month	52/50	N/A	bid 2.2107 − .0052 = 2.2055 ask 2.2113 − .0050 = 2.2065	2.2055/65

To rely constantly on short-date swaps is risky. For one, swapping into and out of positions on a daily basis creates extra transaction costs and other back room operational costs. Also, short-date swap rates are at times affected by special factors such as tax payment dates and month-end dates (ultimo).

Option Forwards

An option-forward contract is defined as a forward-outright contract where the delivery date is at the option of the customer. As in a normal forward-outright contract, the parties agree at the time of the deal on the size of the transaction, the currencies involved and the exchange rates involved. The delivery date is fixed between any two dates.

Settlement

Settlement for the option-forward contract is two business days after the exercise of the option. The determination of the settlement date corresponds to settlement dates of spot contracts.

Option-Forward Rates

Quotation. In quoting rates for option-forward contracts, banks consider the possibility that customers exercise the option at the worst possible time. Suppose the following DM/$ rates are quoted:

	DM/$	*DM/$ Outright Quotes*
Spot	2.2107/13	2.2107/13
1 month	52/50	2.2055/63
2 months	91/89	2.2016/24
3 months	134/136	2.1973/81
6 months	270/265	2.1837/48
12 months	533/523	2.1574/90

A customer wants to buy U.S. dollars (sell German marks) forward with the time option from spot to three months. Suppose the bank quotes the U.S. dollar at the three months forward rate. The customer exercises for spot delivery. The customer can sell

spot German marks at the full forward premium. Obviously, the bank has to take the worst case into account. The bank, therefore, would quote the current spot price. Suppose, on the other hand, that the customer wants to sell U.S. dollars (buy German marks) forward with the same time option. Suppose the bank quotes the U.S. dollar at the spot rate. The customer exercises for three-month forward delivery and is able to sell the U.S. dollars in three months at no forward discount (buys the German marks at no premium). To avoid this situation, the bank would quote the customer the three-month forward price. Thus for a spot-three month option-forward transaction the minimum spread would be 2.1973/2.2113. Minimum spreads for other possible option-forward contracts are:

Spot–1 month	2.2055/2.2113	1 month–2 months	2.2016/2.2063
Spot–2 months	2.2016/2.2113	1 month–6 months	2.1837/2.2063
Spot–3 months	2.1973/2.2113	3 months–6 months	2.1837/2.1981
Spot–6 months	2.1837/2.2113	3 months–12 months	2.1574/2.1981
Spot–12 months	2.1574/2.2113	6 months–12 months	2.1574/2.1848

Why would customers ever enter foreign-exchange transactions with such wide spreads? The alternative to an option-forward contract is to enter a forward-outright contract with a "best guess" maturity date and then roll over the forward contract with short-date swaps to the exact delivery date. However, this technique might require many swap transactions for which the customer pays a spread each time. Because spreads are usually relatively large on short-date swaps as well as influenced by extraordinary circumstances, the alternative of the option-forward contract is often superior.

Cross-Currency Swaps

In this section we discuss the recently introduced cross-currency swaps. These are different from the classical swaps discussed earlier in that they have interim cash flows and are typically of larger tenor. Because they have been traded by the capital-market groups of commercial and investment banks, they have also been called capital-market swaps.

A currency swap is an exchange of cash flows, in different currencies and over time, between two parties. In a typical currency swap, parties exchange principal in one currency for principal in another currency at the outset, and re-exchange these principals at maturity. Usually, and unlike the classical swap, the initial and final rates of exchange are identical. To account for this, there are interim interest payments reflecting market rates in the respective currencies to service the principal amounts. The interest payments are set according to a predetermined rule.

To illustrate, assume that party A and party B enter into a five-year German mark/U.S. dollar swap at an exchange rate of 2.0000 DM/$, a 5 percent DM interest rate, and a 10 percent $ interest rate, with yearly interest payments. If party A initially receives $1 million, it must initially pay DM 2 million. At maturity, party A pays back the $1 million and receives back the DM 2 million. Naturally, party B has the other side of these transactions. In addition, since party A is the original receiver of the $1 million, it services this principal amount by making $100,000 (10 percent of $1 million) yearly payments to party B for five years. Similarly, since party B is the original receiver of DM 2 million, it makes DM 100,000 (5 percent of DM 2 million) yearly payments to party A for five years.

There are many variants to the preceding transaction, particularly because the markets have been evolving very rapidly. Specifically, the interim interest payments can be floating or fixed for either or both of the currencies. If so, the swap can take on various names such as fixed to floating or floating to floating cross-currency, annuity or coupon cross-currency, or cross-currency interest-rate swaps. Because the usage of these names is not standard, it is best to clarify specific meanings in case of doubt.

On some rare occasions, the interim payments might also amortize the principal, and the swap is called amortizing. There are also forward swaps where the swaps are entered into at some future date, and options on swaps where the holder of the options has the right but not the obligation to buy or sell a swap.

Currency swaps evolved from parallel or back-to-back loans arranged between two companies in different countries. These were popular in the United Kingdom in the late 1960s and early 1970s as a means of financing investment abroad without violating foreign-exchange regulations.

To illustrate, suppose a British firm wants to invest abroad but cannot obtain the foreign exchange due to government controls. It can, however, make a British pound loan to a U.S. company operating in the United Kingdom. The U.S. company in exchange makes a U.S. dollar loan, outside of the United Kingdom to the British company, which invests the proceeds as it pleases. This is virtually identical to a cash collateralized foreign-exchange loan where the British company deposits cash with a British bank in the United Kingdom and borrows U.S. dollars from the foreign subsidiary of the British bank. This enables the British company to invest abroad and the U.S. company to invest in the United Kingdom with neither incurring foreign-exchange risk.

Parallel loans suffer from several problems. First, default by one party does not release the other from making its contractually obligated payments. Second, although the loans offset one another, they remain on the balance sheet for accounting and regulatory purposes. Third, documentation requirements are extensive. Swaps were developed in the early 1980s to overcome these problems. The documentation of a currency swap does not include an initial exchange of principal, and as such is an off-balance-sheet instrument. Usually, the initial exchange of principal takes place as a separate foreign-exchange transaction. Differences in regulatory, accounting, legal, and supervisory domains notwithstanding, swaps and parallel loans have identical cash flows. Because of the offset feature though, swaps have lower credit risk than back-to-back loans.

Ignoring the initial exchanges, both treasury and capital-market swaps are similar to forward contracts. The only difference is that the capital-market swap has interim interest payments. This renders a capital-market swap less risky than a forward, and this is probably why these swaps have extended the maturities of long-dated currency cover.

Traditionally swaps were used to transform the currency base of liabilities, hence the name liability swap. These were made popular by the historic Swiss franc/U.S. dollar and German mark/U.S. dollar currency swaps between IBM and the World Bank in 1981.

The World Bank wanted to borrow Swiss francs because Swiss franc interest rates were much lower than U.S. interest rates, and the World Bank's own forecast of the dollar/franc

exchange rate pointed to a much stronger dollar than that dictated by the interest-rate parity theorem. That is, the World Bank was willing to take on a Swiss franc liability, regardless of the exchange risk. In addition, the World Bank could also lend Swiss francs to various developing countries. It, however, did not want to borrow through the relatively small Swiss market because the World Bank was afraid that the size of its debt issue would be relatively large. In addition, as it had issued Swiss franc debt several times before, it had an inkling that the market's appetite for its debt was saturated. What the World Bank really wanted was to raise money in the United States and convert that to a synthetic Swiss franc liability.

On the other hand, IBM thought that by raising money in Switzerland and swapping it into dollars, it could get a slightly better rate than in the United States. There are several possible reasons for this: Swiss investors probably thought more favorably of IBM than American investors (the name effect); they wanted to diversify their portfolios with IBM stock (the portfolio effect); and regulatory considerations (such as Securities and Exchange Commission rules making it cheaper to raise money in the Euromarkets than in the United States). Regardless of the reasons, it was wise for IBM and the World Bank to raise money in Switzerland and the United States, respectively, and then swap their liabilities into their preferred currencies.

The very process of exploiting arbitrage opportunities eliminates them. That is, if IBM can borrow at lower cost in Switzerland than in the United States because of its perceived name, after a while it would flood the Swiss market with its debt obligations, drive up its borrowing costs, and no longer find it profitable to borrow in Switzerland.

If this were the major driving force behind currency swaps, the market should have contracted. On the contrary, this market is estimated to have grown from $1.5 billion in 1981 to $40 billion in notional principal in 1986. This suggests that swaps are possibly driven by tax or regulatory considerations rather than the name effect. It is noteworthy that most of these swaps are typically associated with Eurobond issues.

Arbitrage opportunities also exist when taxes or other regulations are present. For instance, Japanese, Australian, and New Zealand domestic interest rates are higher than their Euro counter-

parts for various reasons such as withholding taxes or simple regulations elevating interest rates. This creates an opportunity to borrow in these currencies in the Euromarkets and then swap into dollars. The buyers of these currencies can, in turn, invest them in their respective countries, earning the domestic country-Euro market edge.

Asset swaps use the same principles as liability swaps. The difference is that they are used to transform the currency make-up of assets rather than liabilities. For instance, investors wishing to invest in Australian companies but not wanting to subject themselves to Australian dollar exchange-rate risk can buy Australian bonds and swap their revenue streams into U.S. dollars, or some other currency, creating what is called a synthetic security. On the other side of the transaction, there may be an investor who buys a non-Australian dollar-denominated Eurobond, swapping the revenue stream into higher-interest bearing Australian dollars, regardless of the exchange risk.

Just like other foreign-exchange instruments, swaps can be used to hedge import payments, export receivables, foreign-dividend payments, debts and investments, and to speculate. As arbitrage opportunities disappear, and tax and regulatory loopholes are closed, this swap usage will probably become more prevalant.

Because swaps effectively reduce market imperfections, they tend to reduce the risks associated with the operation of the financial system. Thereby, they render a more efficient functioning of the system and make available transactions that were not available before. Were it not for cross-currency swaps long-dated forward contracts would probably not be feasible.

Futures

Futures contracts traded on organized futures exchanges are conceptually similar to forward contracts traded in the interbank market. The distinction lies in the contract specifications, as well as in the organization and operation of the marketplace. A foreign-exchange futures contract contains the obligation to buy (long) or sell (short) a specified amount of a foreign currency at a presently specified price. Futures contracts on foreign currencies are traded on the International Money Market (IMM, a subdivision of the

Chicago Mercantile Exchange), the London International Financial Futures Exchange (LIFFE), and various other (secondary) exchanges such as the Singapore International Monetary Exchange (SIMEX) and the MidAm Exchange in Chicago (a subsidiary of the Chicago Board of Trade). Though contract specifications as well as trading and clearing procedures differ among the exchanges, the following describes the fundamental differences between exchange-traded futures contracts and over-the-counter-traded forward contracts.

Traded Currencies

In the over-the-counter (interbank) market, forward contracts are traded in almost every conceivable foreign currency. The number of currencies traded on exchanges is limited and includes the German mark, Japanese yen, British pound, Swiss franc, French franc, Canadian dollar, the Australian dollar, and the European Currency Unit. However, trading in these currencies is so liquid in the interbank market that these currencies make up well over 90 percent of all foreign-exchange trades.

Base Currencies

Though most foreign-exchange transactions in the interbank market use the U.S. dollar as one of the currencies involved, cross-currency deals, that is, deals that do not include the U.S. dollar, are possible. On the other side, all futures contracts use the U.S. dollar as the base currency. Cross-currency futures contracts are not traded at this time.

Contract Size

The size of interbank market transactions is negotiable and usually fixed in U.S. dollar terms. Contracts on futures exchanges are standardized and fixed. In addition, the size of the contracts is determined in terms of the foreign (non-U.S.) currency. For example, the size of the German mark contract on the IMM is DM 125,000. Deals can, therefore, only be done for DM 125,000 or multiples of it.

Maturity Dates

Transactions for any maturity date are possible in the over-the-counter market. The length of the contract is determined by the

two involved parties. For most interbank transactions, though, the length of contracts is standardized, that is, contracts for one week, one month, or two months are the norm. Contrary to this, futures contracts have a fixed delivery date (and last trading date). For example, on the IMM, delivery dates are always on the third Wednesday of the expiration month (June, September, December, March). The last trading day is the preceding Monday.

Trading Hours

Trading in the interbank market can take place 24 hours and seven days a week. Liquidity on Saturdays and Sundays and during off-hours is limited. Trading on organized exchanges is limited to the peak hours on weekdays only. This severely limits the use of exchanges during volatile periods to participants with no access to the interbank market. Exchanges are reducing this disadvantage by expanding trading hours and by linkages with other exchanges covering different time zones.

Quotations

In general, European quotes are used in the interbank market. For example, the exchange rates for German mark/U.S. dollar transactions are given in DM per U.S. dollar. Exchanges use American quotes because the contracts are fixed in units of the foreign (non-U.S.) currencies. As in the interbank market, exchanges quote a two-sided market with bid-ask prices.

Transaction Costs

Quoted prices in the interbank market are not directly comparable to exchange quotes. Orders in the interbank market are executed flat. No commissions are added to purchase orders at the offer price nor deducted from sell orders at the bid price. On exchanges, orders are executed at the best available price. Commissions are then added to the total purchase price or subtracted from the amount of the sale.

Delivery

In practice, almost all forward-outright contracts in the interbank market are settled by delivery of the underlying currencies. In contrast, only a very small percentage of futures contracts are

delivered. Most positions in futures contracts are reversed before the delivery date by entering into the exact opposite of the original transaction.

Decentralization/Centralization

Dealers in the interbank market transact their business on a private, one-to-one basis. This implies that quoted prices deviate among participants. Price dissemination is decentralized. On the other side, members of a futures exchange operate around a common trading pit, openly calling out their bids and offers. At any point in time, there is (should be) only one best bid and one best offer price. In this sense, futures price dissemination is centralized.

Lines of Credit/Margins

Any party in a foreign-exchange transaction faces the risk that the counterparty will not fulfill its obligations. To limit this risk, interbank-market participants establish lines of credit with each other for foreign-exchange dealings. These lines of credit reflect the creditworthiness of the counterparties. The foreign-exchange position with each counterparty is thus limited. The credit risk is established with the direct counterparty.

To evaluate the credit risk involved in futures trading, the creditworthiness of the original counterparty is irrelevant. The risk is managed by a margining system. Exchange-market participants must post a good-faith deposit. This initial margin guarantees the performance of each contract. The financial integrity of exchange-traded contracts is further enhanced by a clearinghouse system in which the exchange and its membership assume the opposite side to each contract and thereby share the responsibility for its fulfillment.

The initial margin is complemented by a variation margin. The clearinghouse collects on a daily basis additional funds from losers and pays those funds into the account of winners. This process of marking-to-market on a daily basis guarantees that the clearinghouse and its members are only at risk for the dollar value of the current trading day's price variation.

The distinction between realized and unrealized gains and losses is important. The initial margin represents the participant's equity. If subsequent exchange-rate changes generate unrealized

gains, the equity in the account is increased by the amount of that gain. Equity over and above the amount of initial margin required to carry one's position is the account excess. The excess may be used to increase the net position or may be withdrawn from the account. Should the account incur a net loss, the equity is reduced by the amount of the loss. If no excess equity is available to cover the loss, the trader is required to deposit additional equity to the account in the form of variation margin. If the contracts are liquidated, that is, unrealized losses are converted to realized losses, there would be no need to deposit additional margins.

Market Size

Aside from the spectacular growth of trading in foreign-currency futures contracts, the exchange market is small compared to the interbank market. Futures exchanges provide access to the foreign-exchange market to participants who otherwise would not be able to use the interbank market due to their credit risk. In addition, futures exchanges provide a centralized price dissemination function unavailable in the over-the-counter market.

Options

Foreign-currency option contracts are relatively new instruments. They are traded both on organized exchanges and in the interbank market. An option gives the buyer the right—but not the obligation—to buy (call option) or sell (put option) a given amount of foreign exchange at a predetermined exchange rate (strike price). For this right, the buyer pays the seller (writer) a premium.

Options on financial instruments, like foreign exchange, are insurance contracts and should be viewed and analyzed as such. Like any insurance contract, the option also has a terminal date called the expiration date. If the option may be exercised before the expiration date, it is called an American option. If the option can only be exercised on the expiration date, it is called a European option.

The premium for a call and put option is determined by several variables: the difference between spot and strike prices, time until expiration, domestic and foreign interest rates, and the expected volatility. Volatility is defined as the annualized standard deviation

of daily exchange-rate changes. The precise mathematical solution of European option prices was first developed by Black and Scholes.

Basic arbitrage techniques such as conversions (buy put, sell call, and buy a forward contract) and reversals (sell put, buy call, and sell a forward contract) maintain (approximate) the correct price relationship between puts and calls of the same exercise price through the foreign-exchange market. Other techniques such as boxes (buy puts and calls with one strike price and sell puts and calls with a higher or lower strike price) maintain (approximate) the correct price relationship between puts and calls with different strike prices through the interest-rate market.

As of now, the language in the foreign-currency option market is not standardized. Participants should be aware that a U.S. dollar/German mark call option could either be a call option on the German mark (against the U.S. dollar) or a call option on the U.S. dollar (against the German mark). Again, differences exist between standardized contracts traded on exchanges and the practice in the over-the-counter market. On most exchanges, call and put options refer to the right to buy or sell foreign (non-U.S.) currencies against the U.S. dollar. In general, call and put options in the over-the-counter market refer to the right to buy or sell U.S. dollars against foreign (non-U.S.) currencies.

According to the definitions of calls and puts, the premium quotations also differ. For call and put options on the German mark against the U.S. dollar, premiums are quoted as U.S. cents per unit of German mark. On the other hand, for call and put contracts on the U.S. dollar against the German mark, premiums are quoted in terms of German pfennigs per U.S. dollar.

Options are very versatile tools for speculative, trading, and hedging activities. Their specific risk-return characteristics allow for limited downside risk while retaining unlimited upside profit potential. These instruments offer both multicurrency investors and international corporations important new tools for dealing with a range of currency-exposure problems. Currency options are attractive both for the corporation and the investor because they are, in essence, insurance policies against unexpected movements in exchange rates. (More details on foreign-currency options are available in Chapter 16.)

RELATIONSHIP BETWEEN EXCHANGE RATES

Spot, forward, swap, futures, and option prices are not independent from each other. In practice, all of the exchange rates are determined simultaneously along with the relevant interest-rate differentials between countries. The following describes the arbitrage conditions which ensure these relationships.

Arbitrage Conditions

Assume the following hypothetical scenario: Interest rates for one-year German mark deposits are 5 percent. The corresponding rates for U.S. dollar deposits are 10 percent. The current spot rate is DM 2.0000/$.

An investor has two choices: first, to invest $100 in the U.S. money market at 10 percent interest, and end up with $110 a year from now. Second, to convert the U.S. $100 into German marks at the current spot rate of DM 2.0000/$, and invest the converted funds (DM 200) in the German money market at 5 percent interest, and end up with DM 210 a year from now.

Which alternative would the rational investor choose? This depends on whether DM 210 is more or less valuable than $110 a year from today. This, however, is unknown today as the spot rate one year from today is unknown. The future spot rate that would make an investor indifferent between receiving U.S. $110 or DM 210 a year from now can be easily calculated. This future spot rate is DM 1.9091/$ (DM 210/$110).

Instead of leaving the German mark position open and facing an exchange-rate exposure, an investor could cover the DM 210 by selling the German marks forward today with a one-year forward contract. As long as the one-year forward rate does not equal DM 1.9091/$, arbitrage opportunities exist.

Suppose the one-year forward rate is DM 1.8500/$. The German mark is relatively expensive in the forward market. Based on this scenario, the rational investor would convert U.S. $100 into DM 200 at the current spot rate and would sell forward the expected sum of DM 210 at the rate of DM 1.8500/$. This covered transaction would ensure a total receipt of $113.51 at the end of the year compared to $110 for the domestic transaction. This profit opportunity would entice all investors to buy German marks against U.S. dollars in the spot market and to sell German marks in the forward market. This would lead to an appreciation of the spot value of the German mark—the spot rate (DM/$) falls—and to a depreciation of the forward value—the forward rate (DM/$) rises—until no more profit opportunities exist.

Suppose, on the other hand, that the one-year forward rate is DM 1.9500/$. The German mark is relatively cheap in the forward market. Based on this scenario, the rational investor would convert DM 200 into $100 at the current spot rate and would buy forward the expected sum of $110 at the rate of DM 1.9500/$. This covered transaction would ensure a total receipt of DM 214.50 at the end of the year compared to DM 210 for the alternative transaction. This profit opportunity would entice all investors to sell German marks against U.S. dollars in the spot market and to buy German marks in the forward market. This would lead to a depreciation of the spot value of the German mark—the spot rate (DM/$) increases—and to an appreciation of the forward value—the forward rate (DM/$) falls—until no more profit opportunities exist.

This arbitrage condition determines only the relative difference between spot and forward rates. It does not determine the level of either rate. This arbitrage condition holds for any level of exchange rates and is manifested in the interest-rate parity theorem.

Interest-Rate Parity Theorem

The interest-rate parity theorem relates forward premiums and discounts of specified maturities to the money-market interest differentials on similar assets denominated in different currencies. As explained earlier, the spot-forward relationship is set by covered, or riskless, interest arbitrage.

For any exchange rate defined as domestic currency units per foreign currency unit, interest-rate parity can be formulated as follows:

$$\frac{F - S}{S} \cdot A = \frac{r_D - r_F}{1 + r_F}, \text{ or}$$

$$\frac{S - F}{F} \cdot A = \frac{r_F - r_D}{1 + r_D}$$

where

F = forward rate
S = spot rate
A = annualization factor (365 or 360/number of days for forward contract)
r_D = domestic money-market rate
r_F = foreign money-market rate

The arbitrage condition according to interest-rate parity only holds if the maturity dates for the money-market investments match those of the forward contracts. This requires that a one-month deposit rate has to be used in conjunction with a one-month forward rate, a six-month deposit rate with a six-month forward rate, and so on. In a previous section the annualized forward discounts of the U.S. dollar against the German mark were calculated. The results are repeated here:

1 month AP/D = −2.8225%
2 months AP/D = −2.4698%
3 months AP/D = −2.4246%
6 months AP/D = −2.4427%
12 months AP/D = −2.4110%

Based on these numbers, a general observation can be made: forward discounts on the U.S. dollar decline as the maturity increases. This means that the spread between U.S. dollar and comparable German mark interest rates narrows as time to maturity increases.

Interest-rate parity does not have to hold precisely because arbitrage transactions are associated with certain transaction costs, no matter how small. Two transaction costs have to be considered before covered interest arbitrage activities are undertaken. First, buying and selling foreign exchange in the spot and forward-outright market are associated with transaction costs, exemplified by bid-ask spreads. Second, covered interest arbitrage involves lending and borrowing activities for which bid-ask spreads exist. Both spreads have to be taken into account before an arbitrage transaction.

The arbitrage condition requires that the alternative investments are identical except for their respective currency denomination. In the preceding example, an investment in a U.S. asset was compared with an asset in Germany. These assets, however, are not identical. For one, the credit risk of the respective issuing banks in the United States and Germany might differ. There is also political risk. The American investor faces the potential risk that the German government may make repatriation of German mark assets impossible on the maturity date. The German investor faces the potential risk that the U.S. government may make repatriation of U.S. dollar assets impossible. In practice, the conditions of interest-rate parity are only met in the Euromarkets. Deposits denominated in U.S. dollars and German marks and issued by the same bank in London or any other offshore center are identical except for the currency denomination. The credit risk is the same as well as the political risk.

For the major international banks, foreign-exchange operations and Euromarket activities are viewed as components of overall asset and liability management. Foreign-exchange traders and Eurodeposit traders sit side by side. If any divergence of forward premiums/discounts develop from interest-rate differentials, both traders react. Forward quotations and Eurodeposit rates are adjusted instantly.

TYPES OF RISKS

Several risks are associated with any foreign-exchange transaction.

Exchange-Rate Risk

When a corporation or bank buys or sells foreign currencies, an exposure called an "open position" is created. Until the time that position can be "covered" by selling or buying an equivalent

amount of the same foreign currency, the firm is exposed to the risk that the exchange rate might move against it.

Management limits the open position dealers may take in each currency. Though practices vary, limits are given for "overnight" positions and often also—though with wider limits—for "daylight" positions.

Interest-Rate Risk

Interest-rate risk arises whenever there are mismatches (called gaps) in the maturity structure of a participant's foreign-exchange book. The foreign-exchange book is the complete tally of all outstanding spot, forward, and swap contracts. This problem is identical to the interest-rate risk of domestic assets and liabilities.

The swap market is primarily used to even out gaps in the interest-rate structure of foreign-currency-denominated assets and liabilities.

Credit Risk

Whenever a firm enters a foreign-exchange contract, it faces a risk, however small, that the counterparty will not perform according to the terms of the contract. In this sense, there is a credit risk, though no credit is extended. To limit this risk, a careful evaluation of the creditworthiness of the counterparty is essential.

Another, and potentially more harmful form of credit risk, called delivery risk, stems from the time-zone differences on settlement days. Inevitably, a U.S. bank selling sterling, for example, must pay British pounds to a counterparty earlier in the day than it is credited with U.S. dollars in New York. In the intervening hours, a company can go into bankruptcy or a bank can be declared insolvent.

Political Risk

At one time or another, virtually every country has interfered with international transactions in its currency. Interference might take the form of regulation of the local exchange market, restrictions of foreign investments by residents, or limits on capital inflows from or outflows to other countries. Participants in the foreign-exchange market should carefully analyze the potential of exchange controls to minimize possible harm.

CHAPTER 3

INTERNATIONAL MONEY AND SWAP MARKETS

Brendan Brown

The international money market is a loose term, widely used, but variously defined. The broadest definition encompasses all short-term debt markets in international monies (those monies which enjoy significant international custom—either from investors, or borrowers, or both). Examples of short-term debts that are traded include bank deposits, bankers' acceptances, commercial paper, Treasury bills, short-term floating rate notes, and various synthetic instruments involving swap markets; for example, synthetic floating rate notes.

The narrowest definition would restrict the term *international money market* to offshore markets in bank deposits where the buyers and sellers (alternatively, borrowers and lenders) are predominately nonresidents of both the offshore center and of the country issuing the currency in question. By this definition, the international money market would be quite small, essentially being restricted to the Euromarkets in London and Luxembourg. An in-between definition would include all short-term debt markets in which there was significant international business relative to domestic business. For example, Eurodollar commercial paper, but not domestic U.S. commercial paper, would fall under this definition.

DEFINING INTERNATIONAL TRANSACTIONS

A schema can be drawn up of the various international transactions in money and credit markets where these are distinguished by their degree of internationality.[1] The transactions are differentiated on the basis of three criteria: first, residence of the debtor (bank in the case of a deposit) relative to the country issuing the given currency; second, residence of the investor relative to the country issuing the given currency; and third, residence of the debtor relative to the residence of the investor.

On the first criterion, the transaction is either onshore (for example, a dollar deposit in the United States, dollar commercial paper issued by a U.S. borrower) or offshore (a dollar deposit in London, dollar commercial paper issued by a European corporation). On the second criteria, the transaction is either domestic (a U.S. investor buying dollar paper issued by any debtor) or foreign (a non-U.S. investor buying dollar paper issued by any debtor). On the third criterion, the transaction is either internal (where the residence is the same for debtor and investor—for example, a British investor buying a deposit in any currency with a British bank or other debts in any currency issued by a British borrower). Or the transaction could be external (where the residence is different for debtor and investor—for example, a British investor buying any debt, in pounds or in any other currency, issued by any non-British debtor).

Within this schema are five possible categories of transactions. *Onshore-internal* transactions are those in which both the investor and debtor reside in the country issuing the given currency; for example, a U.S. resident buying Eurocommercial paper in dollars issued by a U.S. corporation. For an *onshore-external* transaction, the debtor, but not the investor, resides in the country issuing the given currency; for example, a German resident buying Eurocommercial paper in dollars issued by a U.S. corporation. In an *offshore-internal* transaction, the investor and borrower reside in the same country but use a foreign currency: for example, a

[1] See B. D. Brown, *The Forward Market in Foreign Exchange* (London: Croom Helm, 1983), chapter 6.

Japanese corporation placing dollar funds with a Japanese bank. For an *offshore-external/domestic* transaction, the currency of denomination is issued by the country of residence of the investor, but not of the borrower: for example, a British investor buying Sterling commercial paper issued by a Swedish borrower. In an *offshore-external/foreign* transaction, the investor and borrower reside in different countries, but neither resides in the country of issuance of the currency used. Examples include the purchase of a deutsche mark deposit at a Luxembourg bank by a French investor, or a British investor buying dollar Eurocommercial paper issued by Gaz de France.

This last transaction—offshore-external/foreign—is the basis of the narrowest definition of international money market. In practice, the volume of such transactions is only a small share of total volume under wider definitions, as shown by the data on international banking flow shown in Tables 3–1 and 3–2. Table 3–1 shows the external position—liabilities and assets outstanding to nonresidents—of banks reporting to the Bank for International Settlements with respect to the countries shown. For example, German nonbank investors in June 1987 had $30.3 billion of deutsche mark-denominated deposits with banks outside the Federal Republic of Germany; U.S. nonbank investors had $195.2 billion of dollar deposits with banks outside the United States (not very dissimilar relative to the German total as a proportion of respective GDPs). Both these deposit totals fall under the definition of *offshore-external/domestic* transactions—as do the interbank loans in deutsche marks (DM) from the Federal Republic ($85.8 billion) and in dollars from the United States ($308.4 billion). The nonbank totals can be compared with those in Table 3–2; they show that nonbank *offshore-external/foreign* deposits in DMs and dollars amounted to $45.0 billion and $240.7 billion respectively.

Further examples of the range of international monetary transactions can be drawn from Tables 3–1 and 3–2. Table 3–2 shows that offshore-internal loans outstanding from banks in the industrialized countries to nonbanks at the end of June 1987 amounted to $43.7 billion in deutsche marks and $236.9 billion in U.S. dollars. Offshore-internal deposits with banks in the industrialized countries from nonbanks amounted to $11.4 billion in DMs

TABLE 3–1
External Position of All Reporting Banks vis-à-vis Individual Countries, June 1987 (In $ Billions)

	Assets		*Liabilities*	
	Bank	*Nonbank*	*Bank*	*Nonbank*
Belgium-Luxembourg	168.5	15.7	158.2	17.4
France	128.2	18.7	116.3	10.4
in Ffrs	6.2	1.6	5.9	1.4
Germany	64.0	53.2	132.0	40.8
in DMs	41.3	40.0	85.8	30.3
Italy	74.8	25.4	54.8	5.9
Netherlands	43.2	17.3	64.6	19.8
Spain	12.5	10.9	28.0	4.8
Sweden	19.2	8.8	9.8	1.6
Switzerland	50.4	11.8	250.0	20.5
in Sfrs	12.8	2.4	53.0	3.7
United Kingdom	373.1	24.7	477.1	26.2
in £s	22.1	4.0	23.6	5.1
Canada	36.7	19.4	34.2	12.2
Japan	405.9	25.5	245.8	5.6
in yen	59.7	8.0	49.9	1.4
USA	376.1	124.9	355.4	211.4
in $	327.2	111.3	308.4	195.2
Hong Kong	147.5	9.6	141.5	15.9
Singapore	116.1	2.0	109.6	2.9
Cayman Islands	104.5	5.5	110.6	5.0
Bahamas	92.1	7.2	105.8	3.9

Source: "International Banking and Financial Market Developments," Bank for International Settlements, October 1987.

and $58.8 billion in U.S. dollars. Table 3–1 shows that nonbank nonresidents held $40.0 billion of DM deposits in the Federal Republic, while nonbank non-U.S. residents held $111.3 billion of dollar deposits with U.S. banks—both amounts falling under the heading of onshore-external transactions.

Our focusing in these and previous examples on the U.S. dollar and deutsche mark is not accidental. As the world's number one and number two international monies respectively, the amount of international business in them is greater than in other currencies. Also promoting the use of offshore-external/domestic transactions

TABLE 3–2
Currency Breakdown of Reporting Banks' Positions in Industrial Countries, June 1987 (In $ Billions)

	With Respect to Nonresidents (External)			*With Respect to Residents (Internal)*	
	Nonbank Assets	*Nonbank Liabilities*	*Official Deposits*	*Nonbank Assets*	*Nonbank Liabilities*
In foreign currency					
U.S. dollar	260.3	240.7	77.5	236.9	58.8
Deutsche mark	77.5	45.0	20.6	43.7	11.4
Swiss franc	21.2	10.4	5.1	42.2	3.8
Japanese yen	17.3	8.2	9.4	10.6	5.6
British pound	6.5	9.5	1.1	3.9	2.9
French franc	4.4	4.0	0.6	4.9	2.3
Netherlands florin	4.0	3.4	1.6	5.2	1.7
Belgian franc	1.6	6.4	0.2	1.0	0.8
Italian lira	3.4	1.4	0.2	1.0	1.0
European currency units	12.0	3.7	1.8	7.0	3.0
Unallocated*	14.4	12.1	2.1	14.4	12.5
In domestic currency	107.9	69.7	57.1		
U.S. dollar	180.2	94.0	51.7		
Other					
Memo:					
Banks in other reporting countries	217.1	199.4	46.2		

* Includes positions of U.S. banks, for which no figures are available.

Source: Bank for International Settlements.

in these two currencies are the regulations imposing extra costs on doing domestic compared to offshore business (for example, reserve requirements and deposit insurance).

IMPORTANCE OF INTERBANK TRANSACTIONS

We shall return to the distinction between the various international money market transactions (using the given criteria) in our discussion of arbitrage relationships. Meanwhile, however, there is a further striking observation to be made from Table 3–1—in addition to the one already made about the importance of international transactions other than those under the heading offshore-external/foreign, which underlies the narrowest concept of international money market. This concerns the huge scale of interbank transactions. For example, banks outside the United Kingdom had $477 billion of deposit liabilities to U.K. banks in June 1987, while U.K. banks themselves had $373 billion of deposit liabilities outstanding to foreign banks. What lies behind such huge totals?

One factor is market making. As in all markets where dealers act as principals in satisfying orders by taking inventory positions themselves—rather than refusing to deal until a transactor in the opposite direction can be found—a substantial amount of business is between the dealers (here, banks) themselves. A bank in London, for example, asked to quote for a large three-month dollar deposit, and having its quote accepted, would seek to lay off its exposure to interest-rate risk (the risk that three-month rates can fall) by finding a would-be borrower of three-month funds. Often, the most readily obtainable borrower is another bank just "hit" in the opposite direction, that is, satisfying a demand for three-month fixed-rate credit and anxious to minimize the time during which it is at risk to a rise in interest rates.

Sometimes the resulting interbank transaction in the preceding example is between two banks in London. But frequently the counterpart is a bank in another center—often in the United States as the deepest money market in dollars is in New York City. Similarly, in the offshore markets in deutsche marks, inventory positions are often laid off in the deeper money market in Frankfurt, explaining a significant share of the interbank positions

outstanding in the Federal Republic as shown in Table 3–1. As a general proposition, the amount of interbank business between an offshore center and the relevant onshore market is more important (relative to total business in the offshore center) the thinner the natural business offshore (nonbank borrowers and lenders wishing to do business there).

Market making, however, cannot explain the large net positions that various countries have with respect to the international interbank market. For example, in the deutsche mark market, German banks at the end of June 1987 had a net creditor position of DM 44.5 billion with respect to banks abroad. Taking all currencies together, U.K. banks had a net creditor position of $105 billion with respect to foreign banks; banks in the United States, by contrast, had a small net debtor position of $20.5 billion with respect to foreign banks. Swiss banks had a huge net creditor position of $199.6 billion while banks in Japan had a huge net debtor position (vis-à-vis foreign banks) of $160 billion.

The net creditor position of German banks in the DM market arises from the giant current account surpluses of the Federal Republic in the mid-1980s. The principal counterpart to these were short-term capital outflows driven by the demand for DM financing from the private nonbank sectors in other European Monetary System (EMS) countries (where the attraction of DM loans was their low nominal interest cost in comparison with domestic loans). In the main, the DM borrowing occurred via the intermediation of the banking sector in these countries, as illustrated by the large volume (DM 43.7 billion) of "internal" Euro-DM loans to nonbank entities (resident in the same country as the bank making the loan) shown in Table 3–2. An example of the underlying transactions would be Italian corporations (especially small and medium-sized ones) borrowing in DMs from a local Italian bank with which they had established relationships, the bank in turn borrowing DMs either from a bank in Germany or in a Euro-DM center (probably London or Luxembourg).

In principle, the Italian bank in the preceding example could have obtained DM funds either directly from the nonbank sector in the Federal Republic (an offshore-external/domestic transaction) or in Italy itself (an offshore-external/foreign transaction), rather than from foreign banks. In practice, however, the net flow of

arbitrage funds in DMs from the Federal Republic to satisfy net demand for DM credit by the nonbank sector in other countries is most likely to come in the form of lending abroad by German banks. These banks, with their established relationships with foreign banks, have an edge over the German nonbank sector. They can more readily and cheaply take advantage of any arbitrage opportunity that arises when DM interest rates are higher outside the Federal Republic than within (this condition reflects net excess demand abroad for DM credit at the prevailing DM interest rate). Moreover, the nonbank sector in EMS partner countries of the Federal Republic would hardly become a large net supplier of DM funds, given the same interest rate advantage in favor of their domestic currency that encourages local corporations to borrow in DMs.

Just as balance of payments developments lie behind German banks' net creditor position in relation to foreign banks, they lie behind the net debtor position of banks in the United States. Before the United States's current account swung into huge deficit, U.S. banks had a large creditor position with respect to foreign banks. A corollary of the deficit has been large capital inflows into the United States, some of which have come via the banking sector. The resulting rundown and subsequent reversal of the U.S. banking sector's creditor position has occurred in a number of ways.

For example, relatively high dollar interest rates induced nonbank sectors abroad to repay dollar loans from banks outside the United States; these banks, in turn, have had less recourse to funds from New York banks. Also operating in the same way has been the reduced official balance of payments financing needs of foreign governments (a counterpart to the widening of the U.S. current account deficit), meaning that some have reduced their outstanding dollar borrowing from banks in the offshore market. Investors outside the United States, attracted by high U.S. interest rates, increased their holdings of offshore dollar deposits, meaning that banks in the offshore market have had a reduced need for loans from the New York money market.

In contrast to the United States and Federal Republic, the net position of U.K. banks with respect to foreign banks (or the Bank for International Settlements (BIS) reporting area) has little to do

with balance of payments developments. Rather, the main factor in the large creditor position of U.K. banks with respect to foreign banks in the rest of the BIS reporting area is London's success in attracting large pools of nonbank deposit business and also deposits from banks outside the BIS reporting area (hence not included under bank positions in Table 3–1, but included under this heading in Table 3–3). London's comparative advantages in obtaining these large pools of funds outstrips its advantages in finding nonbank foreign loan customers; the resulting surplus is absorbed to a large extent in the form of net lending to foreign banks within the BIS reporting area.

Tables 3–3 and 3–4 show that the pools of funds London attracts include: first, deposits from central monetary institutions that choose London as the number one center in which to place reserves held in the form of Eurodeposits. Second, U.S. nonbank residents may well place over half their holdings of Eurodollar

TABLE 3–3
External Position of U.K. Monetary Sector and Other Financial Institutions, June 1987 (In $ Billions)

	United Kingdom	
Analysis by Sector	*Liabilities*	*Claims*
Sterling		
Liabilities to/claims on:		
Central monetary institutions	3.7	1.7
Other banks	33.5	27.6
Other nonresidents	34.1	26.9
US dollars		
Liabilities to/claims on:		
Central monetary institutions	41.7	13.0
Other banks	313.2	352.3
Other nonresidents	141.4	107.9
Other currencies		
Liabilities to/claims on:		
Central monetary institutions	24.9	3.9
Other banks	178.1	173.4
Other nonresidents	37.4	58.6

Source: Bank of England.

TABLE 3–4
External Position of U.K. Monetary Sector and Other Financial Institutions, June 1987 (In $ Billions)

	United Kingdom Liabilities		*United Kingdom Claims*	
Analysis by Country	*Pounds*	*Foreign Currency*	*Pounds*	*Foreign Currency*
BIS Reporting area				
Belgium Luxembourg	2.5	39.8	4.5	41.7
France	4.3	31.9	6.2	31.3
Germany	1.4	50.8	0.5	28.2
Italy	1.5	14.0	2.1	28.6
Netherlands	4.2	17.5	2.3	13.7
Spain	1.4	12.4	1.6	7.7
Sweden	0.4	3.1	1.0	7.0
Switzerland	8.4	84.0	1.9	15.2
Japan	1.2	66.4	1.8	140.5
United States	4.5	161.2	3.0	122.2
Other industrial	7.4	26.6	5.5	44.7
Hong Kong	2.2	20.8	1.9	28.9
Singapore	1.7	12.9	1.0	25.9
Caribbean	3.5	41.5	2.4	32.5
Others				
Bermuda	0.8	7.4	0.1	1.4
W. Europe	3.4	9.5	1.8	14.6
Australia	0.5	1.5	1.4	7.3
New Zealand	0.3	0.7	0.4	2.7
South Africa	0.7	0.9	0.7	7.3
Organization of Petroleum Exporting Countries	6.8	35.0	4.1	6.5
Taiwan	0.3	14.7	0.0	1.2
Other non-oil Less Developed Countries	7.4	27.3	6.5	49.4
Eastern Europe	0.6	6.7	1.9	18.0

Source: Bank of England.

deposits in London (for the total U.S. nonbank holdings amounting to $195 billion, see Table 3–1). Third, banks outside the reporting area—largely in the Third World and in Caribbean offshore centers—use London as the number one market for placing Eurodollar deposits. The Caribbean centers are to a large extent recycling deposits they themselves have received from, say, Latin America.

TABLE 3–5
Swiss Fiduciary Business, December 31, 1986 (In Sfr Billions)

	Banks' Fiduciary Deposits from Abroad	*Banks' Placement of Fiduciary Deposits with Banks Abroad*
BIS area	44.4	150.2
Belgium	4.0	19.7
West Germany	4.6	4.9
France	7.3	12.3
United Kingdom	10.0	46.0
Italy	9.2	1.2
Japan	0.4	0.4
Canada	1.0	3.2
Luxembourg	1.2	35.9
Netherlands	1.5	21.0
United States	4.0	2.1
Others	1.2	3.3
Other W. Europe	3.5	0.1
Greece	0.7	0.7
Monaco	3.1	0.1
Spain	2.1	0.2
Turkey	1.9	0.7
Others		
Other industrialized countries	0.1	0.1
Eastern Europe	22.1	9.8
Caribbean	9.8	1.4
Latin America	31.4	0.7
Middle East	5.9	0.4
Africa	7.0	0.5
Asia	0.0	0.4
Others		

Source: Swiss National Bank.

The position of London as a large net lender to banks in the reporting area should not disguise the fact that it is a large debtor of Swiss banks and to a much smaller extent of German banks. But these debtor positions are in large part offset by London's creditor position with respect to Japanese banks. Some part of the Swiss banks' net creditor position with respect to foreign banks can be explained as a counterpart to Switzerland's continuing large current account surplus (the nonbank sector in many European countries being a net borrower of low-interest-rate francs—see Table 3–2). A large part of the creditor position can be explained by the role of Swiss banks as fiduciary agents (see Table 3–5), whereby they place their customers' funds in the Eurodeposit market under the name of the bank, but at the customer's risk.

Japanese banks' large net indebtedness to foreign banks, especially in London, is in contrast to Japan's role as the number one creditor nation. Long-term capital exports from Japan, however, far outstripped the current account surplus through the mid-1980s, the balance being financed by short-term capital inflows via the banking sector. And already, before the years of large surplus, Japanese banks were major borrowers abroad to finance Japan's international trade. Some of the long-term capital outflows from Japan created direct counterpart short-term capital inflows through the banks. For example, there were large-scale purchases of U.S. Treasury securities on a hedged basis—the investor either financing the purchase by borrowing short-term dollars or by buying yen forward against dollars, which would induce arbitrage inflows of short-term capital via the banks.

INTERNATIONAL LIQUIDITY CRISIS

The large net creditor and debtor positions of various centers vis-à-vis foreign banks is highly relevant to understanding what would be the impact of a liquidity crisis on international capital flow. The most likely trigger to a liquidity crisis is a sudden increase in the perceived risk of lending to banks, perhaps induced by a major default, say, of a bank or a large debtor. In response, banks would curtail their lines of credit to other banks and in particular to foreign banks, as any lifeboat operation launched by

national authorities might well provide a lower order of rescue for foreign lenders (depositors) than for domestic depositors. In the process of contraction of cross-border interbank lending, countries whose banking systems are heavily indebted abroad would suffer an outflow of capital, and the scope of central banks in these countries to act as lenders of last resort could be limited by a shortage of foreign-exchange reserves.

Among the countries in the BIS reporting area, Japan stands out as the country with the largest net indebtedness to foreign banks. In an international liquidity crisis, Japanese banks could find it impossible to renew all external credits falling due, and request accommodation from the Bank of Japan which would dip into its foreign-exchange reserves. Many of the banks refusing to renew credits would be in London, given the large indebtedness of Japanese banks in the London Euromarket—see Table 3–4. These London banks in turn would be subject to a withdrawal of credits by banks in Switzerland, the Federal Republic, and the Caribbean who themselves have net creditor positions in London.

The withdrawal of credits by Swiss banks has somewhat different currency implications from those by other major groups of banks. This follows from the fact that the Swiss franc is not a reserve currency and so the repatriation of funds to Switzerland, whether by banks on their own account, or in their capacity as fiduciary agents for clients, would have no counterpart in an official sale of francs by the central bank in the debtor country (here debtor refers to the external position of the banking sector). Hence the Swiss franc would come under upward pressure.

By contrast, the withdrawal of credits by German banks would trigger large official sales of the deutsche mark; thus, dampening its appreciation in the foreign exchange market. Much of the German banks' foreign lending to other banks is in DMs (see Table 3–1) and is to an ultimate debtor in other EMS countries. Central banks there would accommodate a new withdrawal of DM orders either by drawing down DM reserves or by using official lines of DM credit with the Bundesbank under EMS arrangements.

Hence, the Swiss franc might well be stronger than the deutsche mark in an international liquidity crisis. A simple reading of Table 3–1, which shows a large net creditor position for banks in London relative to foreign banks in the BIS reporting area, would

suggest that the pound could also be strong in a liquidity crisis. There are, however, other considerations pointing in a different direction. First, banks in London have a large net indebtedness to banks outside the reporting area, some of which would themselves be in the front line of credit withdrawal and, in turn, be forced to meet this by reducing balances with U.K. banks. Second, London's role as deposit-taker from central banks could be in jeopardy, if these respond to increased banking risks by moving funds to the United States—either into Treasury bills or into U.S. banks. (Later we discuss why U.S. banks might be considered safer than London banks.) Third, a large share of the nonbank U.S. resident-held deposits in London could be repatriated (again based on the view that U.S. banks are safer—an extra inducement here being the deposit insurance that U.S. nonbank residents would enjoy at home). Fourth, U.K. registered banks—the ultimate constituency of the Bank of England in its role as lender of last resort—do not have a worldwide net creditor position vis-à-vis foreign banks in the reporting area. (In Table 3–6 the figures for U.K.-registered banks include the positions of branches abroad.)

This last point can be elaborated. The general assumption is that in an international liquidity crisis the appeal to the lender-of-last-resort function is based on nationality rather than residence. Thus a branch of a British bank in New York suffering a run on its deposits would look to its head office, which in turn would look to the Bank of England, rather than to the U.S. Federal Reserve, for accommodation. One implication is that international deposits with a bank of nationality X, where that nation's banking system is heavily indebted (or a net basis) to foreign banks and has a large volume of deposits outstanding in foreign currencies, and where the central bank of nation X has a low level of foreign-exchange reserves, are particularly exposed to danger in an international liquidity crisis.

Conversely, international deposits with a bank of nationality Y, where that nation's banking system has a creditor position with respect to foreign banks (on a net basis) and conducts most of its external deposit and loan business in Y's currency, and where the central bank of nation Y has a high level of foreign-exchange reserves, have a low exposure to danger in an international liquidity crisis. In broad terms, Swiss, German, and U.S. banks, all

TABLE 3–6
Net International Assets of Banks by Nationality of Ownership, September 1986 (In $ Billions)

Parent Country of Bank	*Net Claims*	*Related Offices*	*Other Banks*	*Vis-à-vis Nonbanks*	*Official Institutions*	*CDs and Other Securities*
Austria	– 0.4	–	– 7.5	– 7.5	– 0.2	– 0.2
Belgium	– 0.8	1.7	–13.2	13.1	– 2.2	– 0.2
Luxembourg	– 0.1	– 0.1	3.6	– 3.6	—	—
Canada	–11.1	8.2	– 2.0	– 8.6	– 4.5	– 4.2
Denmark	– 0.5	3.3	– 7.2	3.8	– 0.3	– 0.1
Finland	– 1.5	– 0.3	– 8.6	7.0	0.4	—
France	10.3	– 6.4	–18.1	45.4	– 8.1	– 2.1
Germany	56.0	–11.6	57.6	24.7	–11.9	– 2.8
Italy	– 2.4	– 1.0	–19.0	23.9	– 1.0	– 5.3
Japan	56.9	–17.4	–67.3	202.7	–23.7	–37.4
Netherlands	5.0	– 0.3	7.4	3.8	– 5.0	– 1.5
Spain	1.2	0.2	6.2	– 4.9	—	– 0.3
Sweden	0.4	0.6	– 9.0	11.3	– 0.2	– 2.3
Switzerland	21.2	–27.0	48.7	6.3	– 6.9	0.1
United Kingdom	–10.5	0.8	14.2	13.0	–10.8	–27.7
United States	21.5	24.2	60.1	3.7	–34.4	–32.1

* Banks' holdings of CDs (for banks in the United States only) less banks' issues of CDs and other securities.

in varying degrees, fall under this heading. Thus, in a crisis, there would be a tendency for depositors to switch funds, in whatever currency, toward banks of those nationalities, increasing the pressures on countries lacking such safe banking systems.

Of several factors favoring the United States as a recipient of funds in an international liquidity crisis, the second and third are not shared to the same degree by the Federal Republic or Switzerland. First, U.S.-registered banks and their branches elsewhere in the BIS reporting area have a large net creditor position in relation to foreign banks (see Table 3–5). The apparent contradiction with Table 3–1, where banks in the United States are shown having a small debtor position, can be explained by the large number of foreign-owned banks in New York funding themselves abroad, and by the importance of U.S. bank branches abroad that not only have a rich deposit base among U.S. nonbank customers but also are net lenders to foreign banks.

Second, U.S. banks do by far the greatest proportion of their international deposit and loan business in U.S. dollars—a proportion substantially larger than that done for international business in marks and francs by German and Swiss banks respectively. Third, insofar as an international liquidity crisis is accompanied by an increased demand for highly liquid nonbank investments, U.S. Treasury bills and bonds stand out from alternatives in other currencies. If the increased demand for U.S. bills and bonds has some counterpart in reduced demand for deposits in nondollar currencies, the U.S. balance of payments would be strengthened thereby.

The last two factors stem from the U.S. dollar's position as the world's number one international currency. This also gives the United States an asymmetric advantage over even Switzerland and the Federal Republic in geographically concentrated liquidity crises. For example, suppose a run were to develop on a big Swiss bank—as occurred in the Chiasso crisis of 1977.[2] International depositors with the bank in dollars or other nonfranc currencies would be unlikely to find suitable alternative placements for all

[2] See B. D. Brown, *The Flight of International Capital* (London: Croom Helm, 1987), p. 392.

their withdrawn funds inside Switzerland whether they incurred exchange-rate risk and switched into franc investments or added to dollar deposits with the other Swiss banks. These banks might lend them to the bank with problems as part of a lifeboat operation sponsored by the Swiss National Bank. Thus, some net outflow of funds from Switzerland would be probable, accommodated by the Swiss National Bank acting directly as lender of last resort (in dollars) to the bank with problems.

By contrast, were an isolated run to develop on a large U.S. bank, as occurred, for example, in the Continental Illinois Bank crisis of 1984, international dollar deposits withdrawn would likely be replaced in alternative investments inside the United States (including deposits with other banks), so deep are the markets for these, and no exchange-rate risk would be involved in the transfer. There could be some net capital outflow on account of the withdrawal of international nondollar deposits from the bank in trouble. For example, depositors in deutsche marks with the U.S. bank would most likely look to reinvest the funds outside the United States and the U.S. banking system. But, as already explained, this source of outflow (foreign currency deposit withdrawal) is likely to be particularly low in the case of the United States.

DEFAULT RISK AND COVERED-INTEREST ARBITRAGE

The ultimate risk in an international liquidity crisis is that one or more countries—most likely those whose banking systems are heavily indebted abroad—will declare a standstill on foreign credits. Historical precedents include most of the belligerent countries in early August 1914 at on the outbreak of World War I, Germany and many of the central European countries in the summer and autumn of 1931, and Mexico in August 1982.[3] The risk of such a moratorium or standstill, however slight, is present in all international investment transactions and stems from the possibil-

[3] See B. D. Brown, *Monetary Chaos in Europe* (London: Croom Helm, 1988), chapter 1.

ity of not only an international liquidity crisis but also of a national economic or political crisis.

So-called political risk—the risk of moratorium, standstill, or exchange restrictions being imposed and so inflicting loss on the creditor—varies between the different broad categories of international transactions described at the opening of this chapter. In onshore-internal and onshore-external transactions, only one political risk is present—that the country issuing the currency in question will impose restrictions. By contrast, in offshore-internal, offshore-external/domestic, and offshore-external/foreign transactions, two political risks are present—that the country issuing the currency and the debtor's country of residence might impose restrictions.

For example, a French resident holding a deposit in francs with a bank in France (an onshore-internal transaction) is subject to one political risk, that France might impose exchange restrictions limiting the convertibility of the deposit into foreign currency. The nonresident holder of the franc deposit in France is similarly subject to political risk, but this is not identical in form or magnitude to that faced by the resident. In particular, exchange restrictions might be introduced with respect to resident but not nonresident funds; if they are introduced with respect to both, the loss inflicted on the nonresident is probably greater than on the resident given the considerable scope for the latter to use "blocked" funds on purchasing domestic goods and services.

A British investor in dollar commercial paper issued by an Italian corporation (an offshore-external/foreign transaction) is subject to two distinct political risks. First, Italy could impose restrictions on resident debtors making the payments in freely convertible currency. Second, in extreme circumstances, the United States might impose restrictions on the transfer of dollars—and all offshore dealings in dollars at some point involve a funds transfer within the political jurisdiction of the U.S. authorities—to certain categories of nonresidents. For example, during World War II transfers of U.S. dollar funds to residents of the Axis countries and of the neutrals became subject to license.

A U.S. investor in the same Italian commercial paper (an offshore-external/domestic transaction) would also be subject to the dual political risk, but of a somewhat different nature. In particular, the risk of the United States interfering with the transferability of funds by residents is less than for nonresidents. An Italian investor in the same commercial paper (an offshore-internal transaction) would be subject to U.S. political risk to a greater degree than the U.S. investor; but the Italian investor would be less at risk from Italian action, in that blocked lira funds could be used at home.

Political risk is one factor that explains international interest-rate differentials, particularly between deposits and other debt instruments denominated in the same currency. For example, one element in the interest-rate differential in favor of Eurodollar deposits in London or Paris over those in New York could be political risk (where comparison is made for rates paid by banks of similar credit rating). There is the remote possibility that in an international liquidity crisis, for example, the convertibility of deposits in London or Paris could be restricted. Other elements to be considered are the greater liquidity of dollar money markets in the United States than offshore and uncertainty whether the Federal Reserve's role as lender of last resort would extend fully to the offshore liabilities of U.S. banks.

When comparing interest-rate differentials between currencies, exchange-rate expectations are likely to dwarf political risk as an explanatory variable. For example, the rate differential between dollar deposits in New York and deutsche mark deposits in Frankfurt reflects foremost the expectation of dollar depreciation against the mark. In addition, the differential might incorporate a combination of positive or negative risk premiums—two of which are exchange risk and political risk. This combined premium is compensation for investors at the margin distorting their portfolios away from neutrality. Such a distortion has a counterpart, in general equilibrium, in balance of payments financing requirements. The neutral portfolio is that which any given investor would hold if the expected rate of return, adjusted for exchange-rate change, were identical on all currencies. The determination of the neutral weights for each involves trade-offs between minimizing variability of the portfolio's purchasing power, minimizing the portfolio's exposure to political risk, and obtaining hedges against other risks to which the investor might be subject. For example, dollar-based investors could justify some holding of

deutsche marks as a hedge against the recession risks to which their equity holdings are subject because the mark tends to rise against the dollar in a U.S. recession.

When comparing covered interest-rate differentials between currencies, political risk is not an element. To illustrate this point, it is useful to outline the transactions involved in covered arbitrage, say, between the dollar and deutsche mark money markets. In effect, the arbitrage spans three markets—the dollar deposit, the deutsche mark deposit, and the mark-dollar swap market. In a three-month mark-dollar swap transaction for $100,000, the transactor buys (or sells) $100,000 spot against marks and simultaneously sells (or buys) $100,000 three-month forward against marks; the swap rate is quoted as a margin—the difference between spot and forward rate—for a given reference spot rate. These three markets form a triangle, in the sense that any transaction in one market can be replicated by effecting transactions in the other two. For example, instead of lending marks for three months, the investor can swap marks into dollars, and lend dollars for three months. Strictly speaking, the investor would also have to sell forward for marks the interest due on the dollar loan. Alternatively, instead of swapping marks into dollars, the dealer can lend marks and borrow dollars to the same equivalent spot value, buying the dollar interest due forward against marks. Instead of lending dollars for three months, the investor can swap dollars into marks and lend marks for three months; again effecting a small supplementary forward transaction.

Covered interest arbitrage involves spotting an opportunity where a transaction can be more cheaply effected indirectly (at the other two corners of the swap-deposit triangle) than directly (at the corner of the same triangle). In practice, arbitrage opportunity only occurs at the most illiquid corner of the triangle—sometimes the swap market, sometimes the less liquid of the two deposit markets.[4] The amount of saving obtained by arbitrage is described as the covered interest margin between the two currencies and this varies according to whether we are looking from the borrower's or lender's viewpoint (or from the swap buyer's or swap seller's)

[4] Brown, *The Forward Market*, chapter 5.

viewpoint, on the assumption that bid-offer spreads in all markets are significant.

Political risk can be present in covered interest arbitrage; in certain situations the arbitrager could suffer loss from the imposition of exchange restrictions or debt moratoria. However, often the political risks in the two "legs" of the arbitrage operation are offsetting. For example, consider the German investor who spots an arbitrage opportunity in the form of depositing U.S. dollars in New York and swapping deutsche marks into dollars, rather than depositing marks in Frankfurt. He assumes political risk in the first transaction. Some of the risk, however, is shed in the second transaction; the party that buys dollars forward from the investor (as part of the swap deal) undertakes to deliver deutsche marks forward, even if dollars meanwhile have become subject to restriction. Thus, political risk is not an element in the covered interest-rate differential between the Frankfurt and New York money markets. Other factors such as relative liquidity, capital and reserve requirements on banks, and convenience considerations are responsible. For instance, at the margin, German investors may be willing to suffer a lower return at home than that which could be obtained via covered interest arbitrage, owing to the convenience of having funds near at hand.

Nor is political risk usually present in covered-interest arbitrage between two Eurodeposit markets in one center. For example, consider covered arbitrage between the Eurodollar and Euromark market in London. Instead of placing a deposit in marks, the investor who swaps these into a dollar deposit assumes no additional political risk. Both the Euromark and Eurodollar deposit in London are subject to the risk of U.K. restrictions; the assumption of U.S. political risk and the shedding of German political risk in the deposit switch is reversed in the forward mark-dollar transaction which is one part of the swap deal. In practice, covered-interest margins rarely exist between Eurodeposit markets in one center; convenience considerations, for example, that are important in explaining covered margins between domestic centers are not highly relevant to comparison within a center. Moreover, because Euromarkets are usually narrower than their domestic counterparts, banks might be more successful in closing arbitrage gaps before becoming subject to capital and reserve requirements.

NEW SWAPS, NEW ARBITRAGE

The conventional swap market at the heart of covered-interest arbitrage is only a distant relative of currency and interest-rate swap markets; first developed in the 1980s, they revolutionized international financial markets. In a straightforward interest-rate swap, borrower A with a fixed-rate liability enters into an arrangement with borrower B who has a floating-rate liability outstanding in the same currency, whereby A will pay B's interest outgoings as they fall due and conversely. In effect, the swap transforms B's liability from a fixed rate to floating rate and A's liability from floating rate to fixed rate. An essential condition for the interest-rate swap to be profitable for a borrower is that A has a comparative advantage (relative to B) in raising fixed-rate finance (perhaps because A's name is especially popular with international investors).

In a straightforward currency swap, say, for U.S. dollars against deutsche marks, borrower A with a fixed-rate liability outstanding in deutsche marks enters into an arrangement with borrower B who has a floating rate liability in U.S. dollars, whereby A will pay B's interest due and effect repayment of B's loan at maturity while B will pay A's interest due and effect repayment of A's loan at maturity. Such an arrangement would be advantageous if B wants to borrow fixed-rate marks, and yet, A has a comparative advantage in tapping the fixed-rate market.

The innovation of currency and interest-rate swaps has introduced an array of new arbitrage opportunities possible in money and bond markets. From the viewpoint of investors, the most important new opportunity is the so-called asset swap. As an alternative to direct purchases of floating-rate assets—whether floating-rate notes, commercial paper (rolling this over on maturity), or deposits (again rolling over)—an investor can create a synthetic floater by purchasing a fixed-rate bond and simultaneously entering into an interest-rate swap.

For example, investor A might spot an arbitrage opportunity to buy $1 million of a three-year fixed-rate bond outstanding of corporation X, with a credit rating of a single A, and simultaneously enter a three-year interest rate-swap. This would involve paying fixed-rate interest due on counterparty B's fixed-rate liability and receiving from B floating-rate interest set with reference to the London Interbank Offered Rate (LIBOR). The margin above LIBOR, which A would receive on the resulting synthetic floater, might be attractive compared to what could be obtained from a direct purchase of single A floaters in the market. Or, if these are not available, the margin could be compared to what the theoretical margin on a single A floater should be; it is calculated by adding the normal margin that single A borrowers must pay over AA borrowers to rates in the market for AA-rated floating-rate notes.

It may be asked how an asset-swap opportunity can exist for the investor without a simultaneous opportunity for corporation X to buy back its own fixed-rate bonds, refinance itself on a floating-rate basis (probably via a bank credit), and enter into an interest-rate swap to convert its floating-rate liability into a fixed-rate liability. Often, size is a barrier to arbitrage by the corporation. In buying back a whole issue, X would drive up the price of outstanding bonds and thereby eliminate any arbitrage opportunity.

Sometimes corporation X could even make a new fixed-rate issue on terms that permit some large investors to immediately enter into an asset swap. This could occur where the issue can be sold at two prices—a higher one to small retail investors and a lower one to the large institutional investors; alternatively, X might see some advantage, albeit at some cost, in obtaining a wide distribution of its paper between banks who buy it as part of an asset swap, perhaps with a view to expanding its scope to obtain bank financing in the future.

Usually, though, asset-swap opportunities are in the secondary fixed-rate market, and in its more illiquid sector (for single A corporate paper, for example), where the absence of ready demand means that at times a big offer of notes in a given issue might drive its price down to a level attractive for synthetic floating-rate note creation. The possibility of asset swaps does, however, set a lower limit to how far the yield on floating rate notes can fall relative to LIBOR even in the case of top-rated issues, although in practice this is never likely to be reached. For example, in the secondary market the margin below London Interbank Bid Rate (LIBID) on a five-year U.S. dollar floating-rate note issue for the United Kingdom could not widen so far that it would be highly

profitable for the investor to instead purchase a five-year fixed-rate dollar issue of the United Kingdom and enter into an interest-rate swap (receiving floating-rate interest and paying fixed-rate interest).

Weighing against asset swaps ever being profitable for prime rated paper is lack of widespread nonbank demand for floating-rate notes and the limited interest of banks in taking paper onto their books at only fine margins above LIBID or at rates below LIBID. The lack of nonbank demand can be explained by such investors' preference for keeping the floating-rate section of their portfolios in short-maturity paper—for example, commercial paper and bank deposits—having already usually large amounts of long-maturity paper through their involvement in fixed-rate paper. In view of the fact that their own credit rating is usually less than prime and that they would have to pay a significant margin above LIBOR for long-term funds, banks can hardly justify buying large amounts of top-rated floaters.

Just as the possibility of asset swaps sets a lower limit to the yield on floaters relative to LIBOR, the possibility of the borrower obtaining floating-rate finance indirectly—by issuing fixed-rate paper and entering into an interest-rate swap (whereby the borrower pays floating and receives fixed interest)—rather than by a direct issue of a floating-rate note, sets an upper limit. In practice, prime borrowers usually find that the margin at which they could issue a floating-rate note is above the upper limit. Sometimes, however, there are exceptions. For example, during a period of considerable inflation uncertainty, nonbank investment demand for floating-rate notes could rise sharply, meaning that margins on even top-rated new issues could fall below the upper boundary.

Sometimes political or other considerations can swing a borrower in favor of making a jumbo floating-rate note issue even at a rate relative to LIBOR somewhat above the theoretical upper limit. For example, the United Kingdom made a jumbo issue in 1986 for $4 billion at a rate relative to LIBID which was widely perceived as higher than what could have been achieved from a series of fixed-rate issues (perhaps in different currencies) together with swap transactions. It would not, however, have been possible to make a jumbo issue of similar size in the fixed-rate market (hence the need for a series of issues) given the much greater risks

incurred by issuing banks in the fixed-rate than in the floating-rate market, and the narrowness of the swap market. If it were known that the United Kingdom were in the market to conclude $4 billion worth of swaps, this would turn the rates there against it. Politically, the U.K. government did not want to be seen as having again become a frequent borrower abroad because the Conservatives had attacked foreign borrowing by the prior Labour government. Instead, a lightning jumbo issue was preferred. An additional consideration could have been unwillingness to enter into huge swap commitments, thus assuming counterparty risk.

Counterparty risk is greater in currency swaps than in interest-rate swaps; the two principal amounts of equal value when the swap is contracted may be of very different value by the end. The significant counterpart risk in currency swaps explains why some apparent arbitrage opportunities involving a crossing of currency frontiers can remain open. In principle, if currency swaps were riskless, then the following parity conditions should hold between, say, Eurodollar and Euromark bond markets of whatever maturity. It should not be cheaper in market equilibrium for a wide range of borrowers to issue a fixed-rate bond in DMs, swap the fixed-rate DMs into floating-rate dollars, and swap the floating-rate dollars into fixed-rate dollars, than issuing a fixed-rate dollar bond. Nor must the opposite inequality be broken (meaning that indirect financing via the dollar is cheaper than fixed-rate financing in marks).

Specifically, the spread that borrowers in the DM bond market must pay above German government yields less the DM currency swap rate (for DM fixed rate to $ floating rate) plus the dollar interest-rate swap should lie within a tight margin of the spread which the same quality of borrower would have to pay above U.S. Treasury bonds. Note that swap rates are expressed relative to government-bond yields, with LIBOR taken as reference point. For example, a five-year DM currency swap rate of 15 points means that a floating-rate dollar liability on which interest is payable at LIBOR can be swapped into fixed-rate DMs at 15 percentage points above the German government-bond yield.

The preceding statement of interest-rate parity between the bond and swap markets can be extended to include intermediation via three rather than two swap markets. Instead of swapping

fixed-rate DMs directly into floating-rate dollars, the arbitrager could swap fixed-rate DMs into floating-rate DMs (a DM interest-rate swap), and then swap floating-rate DMs into floating-rate dollars (a so-called LIBOR–LIBOR swap). The arbitrager could go one step farther. Instead of effecting the LIBOR–LIBOR swap, for the given maturity of five years (a floating-rate dollar liability being swapped for a floating-rate mark liability), the arbitrager could effect a conventional six-month swap (borrowing dollars for six months and lending marks for six months is equivalent to selling dollars six months forward against marks, which in turn is equivalent to a spot sale of dollars against marks plus a conventional dollar-mark six-month swap in which dollars are simultaneously bought spot and sold forward), rolling this over at maturity throughout the five-year period. Here the distant relationship of currency and interest rate swaps to the conventional swap reveals itself.

The two interest-rate parity theorems described involving first, the interest-rate swap market and the floating-rate note market and second, currency plus interest-rate swaps and yield spreads in two bond markets of different currency denominations, are essentially statements of static equilibrium conditions. They are analagous to the better-known interest-rate parity theorem relating the conventional swap rate to interest rates in two money markets of different currency denominations. The dynamics of arbitrage—the relative extent by which swap rates and bond yields adjust under the pressure of arbitrage from an initial disequilibrium position—is not within the scope of this chapter. Nor are the separate constraints on arbitrage possibilities that arise from the possibility of producing currency and interest rate swaps synthetically—at least for maturities up to around two years—by transactions in the interest-rate and currency futures markets.

CHAPTER 4

THE ART OF CENTRAL BANKING

Joseph Bisignano

The practice of central banking in any country depends on the structure of its financial institutions and markets, its economic and political history and, to some degree, prevailing academic economy orthodoxy. No doubt, it also depends on the personalities of the individuals who exercise central banking policy. This chapter describes what some have referred to as the "art" of central banking from several of these vantage points, with particular emphasis on the United States, but with considerable illustration drawn from the financial structures and policy execution in other large industrial countries.

Concentrating attention on central banking in the United States is obviously of greatest interest to American financial analysts, corporate treasurers, and the like, but such focus carries with it two potential handicaps. First, viewing central banking in general from a U.S. vantage point obscures the fact that money and capital markets abroad are in many cases considerably less well developed than those in the United States. There is a tendency for U.S. economists and financial analysts to casually extrapolate U.S. institutional and financial market experience in their interpretation of financial market events abroad and to view foreign central

The views expressed here are those of the author and not necessarily those of the Bank for International Settlements. My thanks to John Kneeshaw and Palle Andersen for helpful comments and to Robert Z. Aliber for over the years always asking me interesting questions.