PART I:

FOREIGN EXCHANGE AND GLOBAL FINANCE

PREFACE TO PART I

Part I introduces the connection between foreign exchange (FX) rates, and corporate results. Part I lays a foundation for more in-depth topics on FX valuation in Part II, corporate cost of capital and valuation in Part III, and financial and risk management policies in Part IV.

Chapter 1 presents introductory aspects of FX rates. After some discussion how to interpret FX rate changes, the chapter shows how uncertain FX rates pose a risk for companies transacting across different currencies. Then the chapter reviews some of the important sources of supply and demand pressures on FX rates and thus why FX rates fluctuate.

Chapter 3 introduces forward FX rates and forward FX contracts. The chapter covers how to find the profit/loss (the difference check) on a forward FX contract at delivery time and the mark-to-market value of a contract prior to the delivery time. Chapter 3 also presents the use of forward FX contracts to manage FX transaction risk. Finally, we cover synthetic forward FX contracts, covered interest arbitrage, and the covered interest rate parity (CIRP) no-arbitrage condition.

Chapter 6 presents some of the basic theory of corporate FX operating exposure, which is the variability in a firm's anticipated future operating cash flow stream caused by unexpected FX changes. This FX operating exposure is long-term in nature, and is more complex and difficult to measure than FX transaction exposure of a specific receivable or payable. If managers are to hedge or otherwise manage a firm's long-term risk to FX changes, they need to be able to understand and measure the exposure. The chapter shows that to some extent, FX operating exposure can be managed by operational hedging, i.e., having operating costs with FX exposures that match the FX exposures of the revenues.

CHAPTER 1. INTRODUCTION TO FOREIGN EXCHANGE

Best to think of this as "the thing that is changing" being in the denominator. The currency in the denominator of the exchange rate expression is the item which is changing. The numerator currency is the stable currency. For example, say the euro is at 1.5 $/€.

$$2.00\$/£ = .50£/\$$$

Say the first number, **2.00/£, goes up to 2.50/£.** Here we say that the "the price of the pound has gone up" (appreciated). The British pound is always quoted as dollars per pound. Looking at the expression you may think that the dollar has gone up from $2.00 to $2.500. BUT THIS WOULD BE WRONG !!! In this case the dollar has gone down against the pound. Keep it straight by always focusing on the denominator currency, that is the quantity which is changing. **When you see the number go up it is the quantity in the denominator which has gone up in value!**

But many other major currencies are quoted the other way. For example, 110¥/$ is always quoted as yen/dollar. Same is true for swiss frank, 1.05 sf/$. This can be confusing!

Australian and New Zealand are the other major currencies.

Different national currencies must be exchanged to conduct global business. A *foreign exchange (FX) rate* is, simply, the price of one currency in terms of another. As with stock prices, complex supply and demand forces determine FX rates and cause them to be volatile.

Many companies operate globally, taking raw materials from some countries, producing parts in other countries, assembling in still other countries, and competing to sell final products in markets around the world. Many other companies operate only in their home country or have only limited international operations. But regardless of the scope of a firm's international operations, volatile FX rates can impact profitability and growth.

This chapter introduces the basics of FX rates and the FX market. We'll also get into the reasons why FX rates are volatile like stock prices and why this volatility is a problem for companies.

FX RATES

The FX rate between US dollars and British pounds can be expressed as either the price in US dollars of one British pound or the price in British pounds of one US dollar. 2 $/£ means that $2 will buy 1 British pound. Equivalently, we could say that the FX rate is 0.50 £/$, which means that £0.50 will buy 1 US dollar. In

general, an FX rate gives the price of the "denominator currency" in terms of the "numerator currency".

The convention in the FX market has been to quote most currencies as the price of a US dollar. For example, a quote of 1.20 for the Swiss franc (the "Swissie") implies 1.20 Swiss francs per US dollar, or 1.20 Sf/$, and 108 for the Japanese yen means 108 yen per US dollar, or 108 ¥/$. When the FX rate represents the FX price of a US dollar in terms of the other currency, the quotation is said to be in *European terms,* even though the pricing currency involved is not necessarily a European currency.

Although most FX quotes are conventionally in European terms, a few are typically quoted as the price (in US dollars) per unit of the other currency, referred to as *American terms*. A quote of 1.45 in the case of the British pound means 1.45 US dollars per British pound, or 1.45 $/£, the FX price of a British pound in US dollars. Other significant currencies usually quoted in American terms include Australian dollars (A$) and New Zealand dollars (NZ$).

The euro (€) is the most significant currency conventionally quoted in American terms rather than European terms. For example, a quote of 1.35 for the FX rate between euros and US dollars represents 1.35 US dollars per euro or 1.35 $/€, the price of one euro in terms of US dollars. The euro is the currency of the 13 countries in the Eurozone, (Germany, France, Italy, Spain, Portugal, Belgium, Netherlands, Luxembourg, Austria, Ireland, Finland, Greece, and Slovenia.)

The tradition that some FX rates are quoted in European terms and others in American terms may contribute to some initial difficulty in relating to changes in currency values. This text generally cites FX rates following the market conventions, as the sooner you get used to these conventions, the more quickly you can absorb pertinent items in the news.

From a country's perspective, an FX rate is said to be in *direct terms* if the home currency is the pricing currency and in *indirect terms* if the foreign currency is the pricing currency. Thus, the FX rate of 2 $/£ is in direct terms from the US point of view. The FX rate of 0.50 £/$ is in indirect terms from the US point of view.

The FX rates seen streaming on Bloomberg TV and CNBC follow the quotation conventions, as are the FX rates shown in Exhibit 1 from the New York Federal Reserve Bank. The FX rates in Exhibit 1.1 are *spot FX rates*, i.e., for immediate payment and delivery, which typically means settlement in two business days. Current spot FX rates corresponding to those in Exhibit 1.1 as well as downloadable historical spot FX rates can be found at the Web site of the New York Federal Reserve Bank (http://www.ny.frb.org/markets/fxrates/noon.cfm). Another useful site for FX information is http://www.oanda.com/index.shtml.

A *cross-rate* is an FX rate between two non-US dollar currencies. A *cross-market* is a market for direct transactions between non-US dollar currencies. If one wants to change euros into yen, for example, one may do so directly in that cross-market. There are relatively deep cross-markets for euros/yen, euros/Swissies, and euros/pounds.

In the absence of a cross-market, the US dollar serves as a *vehicle currency,* meaning that to exchange one non-US dollar currency for another involves two trades, first to exchange one currency into US dollars and then to exchange the US dollars into the second currency. In a vehicle currency system, the cross-rate quote is an indirect, derived cross-rate. Thus, if yen trades at 125 ¥/$ and the Swiss franc trades at 1.50 Sf/$, the derived cross-rate would be 125 ¥/$ ÷ 1.50 Sf/$ = 83.33 ¥/Sf.

EXHIBIT 1.1
FEDERAL RESERVE BANK OF NEW YORK
SPOT FX RATES

CURRENCY AREA	UNIT	10/27/03	1/14/08
* Australia	Dollar	0.7038	0.8981
Brazil	Real	2.871	1.7346
Canada	Dollar	1.3107	1.021
China, P.R.	Yuan	8.2767	7.2526
Denmark	Krone	6.323	5.0025
* Eurozone	Euro	1.1762	1.4877
Hong Kong	Dollar	7.7541	7.8036
India	Rupee	45.40	39.14
Japan	Yen	108.38	108.18
Malaysia	Ringgit	3.80	3.2529
Mexico	Peso	11.1195	10.9125
* New Zealand	Dollar	0.6097	0.79
Norway	Krone	7.023	5.2637
Singapore	Dollar	1.743	1.4294
South Africa	Rand	6.88	6.74
South Korea	Won	1183	937
Sri Lanka	Rupee	94.45	108.2
Sweden	Krona	7.725	6.308
Switzerland	Franc	1.3159	1.029
Taiwan	NT Dollar	33.95	32.33
Thailand	Baht	39.99	29.65
* United Kingdom	Pound	1.6952	1.958
Venezuela	Bolivar	1600	2.144

* These rates are quoted in U.S. dollars per foreign currency unit.
All other rates are quoted in foreign currency units per US dollar.

In 2001, over 90% of all spot FX trades involved the US dollar, nearly 38% involved the euro, 23% the Japanese yen, 13% the pound sterling, 6% the Swiss franc, and 2.6% the Swedish krona (Exhibit 1.2). The source of these statistics is the Bank for International Settlements (BIS) triennial survey.

EXHIBIT 1.2

Currency Distribution of Reported FX Market Turnover
Percentage Shares of Average daily Turnover, April 2001; Total = 200%.

US dollar	90.4
Euro	37.6
Japanese yen	22.7
Pound sterling	13.2
Swiss franc	6.1
Swedish krona	2.6

Source: Bank for International Settlements:
http://www.bis.org/publ/regpubl.htm

Say you want to convert an amount in dollars, $20,000, to yen, given an FX quote of 125 ¥/$. In this case, you should multiply the amounts, since the dollar symbol in the denominator of the FX rate will "cancel" with the dollar symbol of the currency amount, leaving the units for the answer in the numerator currency symbol of the FX rate, yen: $20,000(125 ¥/$) = ¥2,500,000 = ¥2.5 million.

Now suppose you are given a yen amount of, say, ¥500,000, to convert into dollars at the FX rate of 125 ¥/$. It would make no sense to multiply ¥500,000 by 125 ¥/$ because there is no cancellation of the yen symbol on the currency amount with the denominator currency symbol of the FX rate, the US dollar. To perform the conversion of yen into dollars at an exchange rate expressed in ¥/$, one can take either of two approaches.

One approach is to reciprocate the FX rate into direct terms from the US point of view, i.e. US dollars per yen, which is 1/(125 ¥/$) = 0.008 $/¥, and then multiply ¥500,000 by the reciprocated FX rate. Thus, you would have ¥500,000(0.008 $/¥) = $4000. Since the currency symbol of the amount, ¥, cancels with the denominator currency symbol (¥) in the FX rate, the answer is in US dollars.

The second approach is a shortcut. Simply divide

¥500,000 by the quoted FX rate, 125 ¥/$, as in ¥500,000/(125 ¥/$). Now the ¥ symbol in the amount will cancel with the ¥ symbol in the numerator currency of the FX rate, while the denominator currency symbol, $, following the basic algebraic principle that a "denominator of a denominator" goes to the numerator and thus becomes the units for the answer: $4000.

FX RATE CHANGES

If the FX rate for yen goes from 125 ¥/$ to 160 ¥/$, this change is an increase in the FX price of the US dollar (in yen), as the US dollar is the "denominator currency." We say that the US dollar has appreciated when the FX rate goes from 125 ¥/$ to 160 ¥/$. This also implies that the yen has depreciated in terms of the US dollar, from 0.008 $/¥ to 0.00625 $/¥.

Suppose that owing to a net Japanese purchase of US investments, yen are currently being sold for US dollars. Then the buying pressure on the US dollar is causing the FX price of the US dollar to rise. Alternatively, we can say that the FX price of the yen decreases in terms of the US dollar because of the selling of yen.

If instead there is buying pressure on the yen, the FX price of the yen increases relative to the US dollar (and the FX price of the US dollar declines relative to the yen), and thus the European terms FX rate declines. For example, an FX rate change from 125 ¥/$ to 119 ¥/$ is a drop in the FX price of the US dollar, i.e., a depreciation of the US dollar relative to the yen and an appreciation of the yen relative to the US dollar.

Thinking of an FX rate in terms of the FX price of the "denominator" currency helps out if you are new to this subject. In the press, however, you will often see confusing announcements like "the yen dropped from 118 ¥/$ to 120 ¥/$" or "the US dollar fell from 1.30 $/€ to 1.32 $/€". Just remember that since the euro appreciates when the FX rate goes from 1.30 $/€ to 1.32 $/€, the US dollar depreciates. So it is not incorrect to say that "the US dollar fell from 1.30 $/€ to 1.32 $/€"--just a little confusing at first.

Some reports on FX rates use the terms *devaluation* instead of depreciation and *revaluation* instead of appreciation. Devaluation has the same result on an FX rate as depreciation, and revaluation has the same result as appreciation. The difference is that devaluation and revaluation refer to a change in an FX rate caused by government policy, while the terms depreciation and appreciation imply FX rate changes caused by other market forces. If a central bank intervenes, or even several central banks in a coordinated effort intervene, in the currency market to try to influence the FX price of a currency, this action represents official policy, and the terms devaluation and revaluation would be applicable.

If the spot FX rate for the Swiss franc declines from 1.50 Sf/$ to 1.20 Sf/$, has the Swiss franc depreciated against the US dollar? If the spot FX rate for the euro declines from 1.38 $/€ to 1.33 $/€, has the US dollar depreciated against the euro?
Answers: No to both*. The Swiss franc has appreciated. Since one US dollar will buy fewer Swiss francs at 1.20 Sf/$, the FX price of the US dollar has depreciated and the Swiss franc has appreciated. In the second question, the FX price of the US dollar has appreciated and the euro has depreciated.*

You can see some changes in spot FX rates from November 2002 to November 2003 in Exhibit 1.3. Both perspectives are shown, American and European terms. In all cases, the American terms FX quote rose, which represents an appreciation of the non-US dollar currency. Correspondingly, the European terms quote fell, representing a drop in the FX price of the US dollar.

The notation for a spot FX rate in this text is the capital letter X. In order to keep things straight, generally we'll follow X with a two-currency superscript. Thus, $X^{Sf/\$}$ represents a spot FX rate in Swiss francs per US dollar, which is in conventional European terms of the FX price of the US dollar (in Swiss francs). $X^{\$/£}$ would represent a spot FX rate in US dollars per British pound, which is the American terms convention for the FX price of the pound (in US dollars).

We'll often use a subscript to denote time, in years from the present. Thus $X_0^{\$/£}$ denotes a current spot FX rate, $X_2^{\$/£}$ the spot FX rate two years from now, $X_{0.50}^{\$/£}$ a spot FX rate six months from now, and so forth.

EXHIBIT 1.3
SPOT FX RATE CHANGES

		American Terms			European Terms		
Country	Currency	Nov-02	Nov-03	Change FC	Nov-02	Nov-03	Change US$
Canada	C$	0.6364	0.7606	0.1242 ⇑	1.5714	1.3147	(0.2567) ⇓
European Monetary Union	€	1.001	1.1645	0.1635 ⇑	0.999	0.859	(0.140) ⇓
Japan	¥	0.00822	0.00916	0.00094 ⇑	121.63	109.12	(12.51) ⇓
UK	£	1.570	1.684	0.114 ⇑	0.637	0.594	(0.043) ⇓
Australia	A$	0.561	0.714	0.153 ⇑	1.782	1.401	(0.381) ⇓
Switzerland	Sf	0.682	0.745	0.063 ⇑	1.466	1.342	(0.124) ⇓
New Zealand	NZ$	0.4975	0.6244	0.1269 ⇑	2.010	1.601	(0.409) ⇓

Exhibit 1.3 Spot FX rates and changes for major currencies for the year from November 2002 to November 2003.

Figures 1.1 through 1.3 depict the movements of three important spot FX rates from 1997 through November 2003: Figure 1.1 shows $/£, Figure 1.2 shows $/€ (from the year 2000), and Figure 1.3 ¥/$ (also shown in American terms, $/¥).

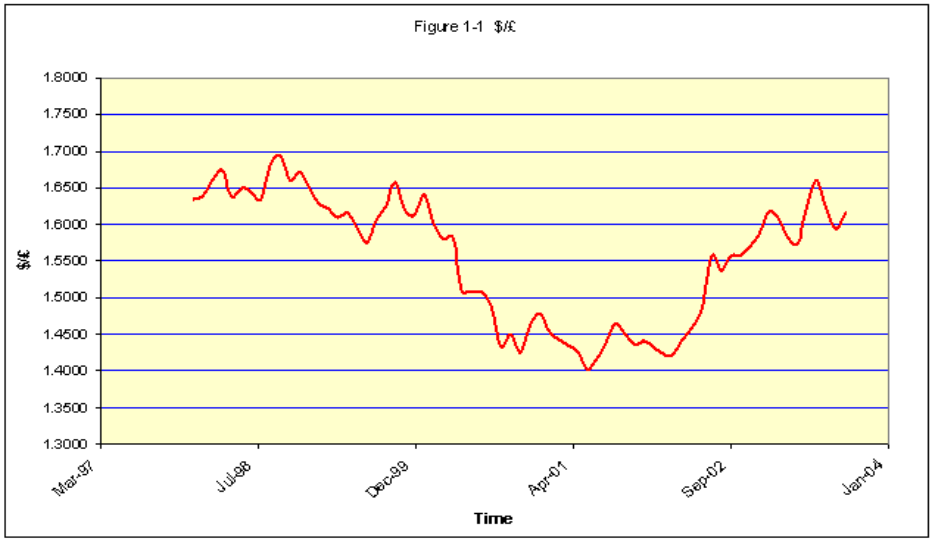


Figure 1.1 The spot FX rate for $/£ from 1997 until November 2003.

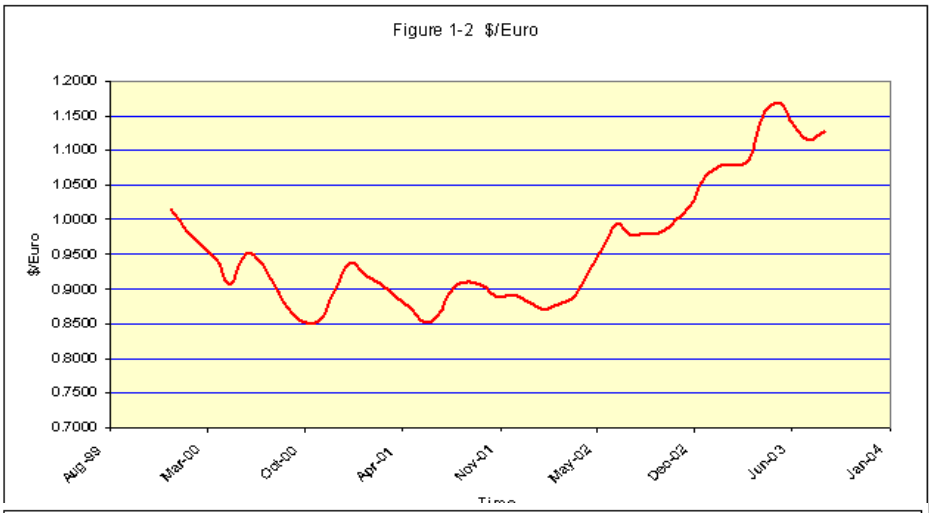


Figure 1.2 The spot FX rate for $/€ from 2000 until November 2003.

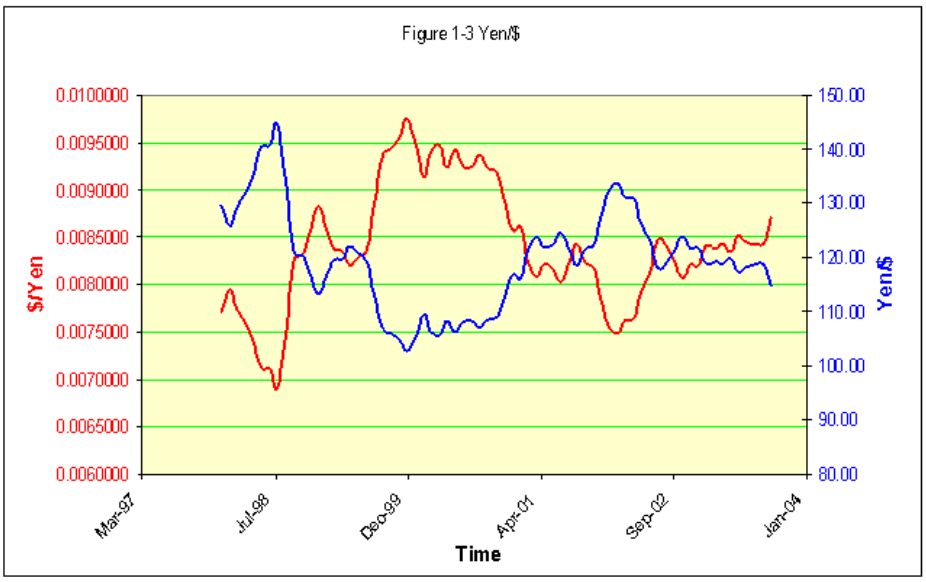


Figure 1.3 The spot FX rate for both ¥/$ and $/¥ from 1997 until November 2003.

US DOLLAR INDEX

Sometimes we want to see how the US dollar is changing relative to other currencies in general. For example, we may want to know how the FX price of the US dollar is doing against other currencies in general. For this purpose, we can use an FX index, like the USDX. The USDX, which also goes by the ticker symbol "DXY" measures the dollar's general FX value relative to a base of 100.00 in March 1973. A quote of 85.00 means the US dollar's spot FX value has dropped 15% since this base period.

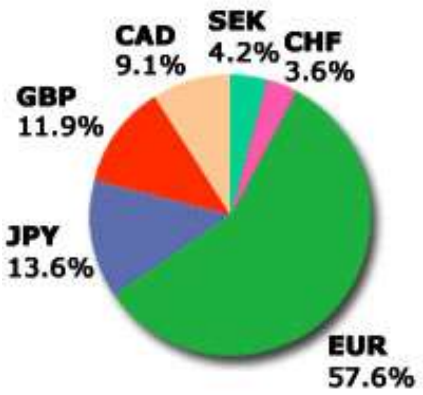
The USDX is calculated as a geometric weighted average of the change in six spot FX rates against the US dollar relative to March 1973. The formula is USDX = $50.14348112 \times (X^{\$/€})^{-0.576} \times (X^{¥/\$})^{0.136} \times (X^{\$/£})^{-0.119} \times (X^{C\$/\$})^{0.091} \times (X^{Sk/\$})^{0.042} \times (X^{Sf/\$})^{0.036}$. The exponents in the formula are the weights, which are the same as those used in the Federal Reserve Board's trade-weighted US Dollar Index. See Exhibit 1.4.

Investors can trade shares based on the USDX using the funds quoted "UUP" and "UDN". The UUP fund rises and falls based on the movement of the USDX. The "UDN" fund does the opposite, as if you are selling the USDX short. If you have a portfolio of foreign investments and are worried about a general rise in the US dollar (a drop in the value of the foreign currencies), you could buy the UDN fund to hedge that FX risk.
Source: http://www.akmos.com/main/forex/usdx.html.

NOT ON EXAM!

EXHIBIT 1.4

Currency	Weight
Euro EUR	0.576
Japanese Yen JPY	0.136
British Pound GBP	0.119
Canadian Dollar CAD	0.091
Swedish Krona SEK	0.042
Swiss France CHF	0.036



EXPECTED SPOT FX RATES AND SIEGEL'S PARADOX

We use the concept of an *expected* spot FX rate for a given horizon in the sense of the mean of a probability distribution of random future spot FX rates that we might observe at that horizon. The true probability distribution of a future FX spot rate is not observable, but it is useful to think about the expected spot FX rate for time N and denote it $E(X_N^{\$/€})$.

Even though $X_N^{\$/€}$ will always be equal to $1/X_N^{€/\$}$, the expected future FX spot rate, $E(X_N^{\$/€})$, cannot be equal to $1/E(X_N^{€/\$})$. That is, if 1.20 \$/€ is the expected spot FX price of the euro a year from now, the expected spot FX price of the US dollar *cannot be* 1/(1.20 \$/€) = 0.833 €/\$, even though it is true that if the actual spot FX price of the euro will be 1.20 \$/€ a year from now, then the actual spot FX price of the US dollar a year from now will be 1/(1.20 \$/€) = 0.833 €/\$.

To see this point, assume there are two equally likely possible outcomes for the future spot FX rate for a year from now: 0.80 \$/€ (≡ 1.25 €/\$) and 1.60 \$/€ (≡ 0.625 €/\$).

Probability	**0.50**	**0.50**
$X_1^{\$/€}$	0.80 \$/€	1.60 \$/€
$X_1^{€/\$}$	1.25 €/\$	0.625 €/\$

The expected spot FX price of the euro for a year from now is thus 0.50(0.80 \$/€) + 0.50(1.60 \$/€) = 1.20 \$/€. At the same time, the expected spot FX price of the US dollar for a year from now is 0.50(1.25 €/\$) + 0.50(0.625 €/\$) = 0.9375 €/\$. You see that $1/E(X_1^{\$/€})$ = 1/(1.20 \$/€) = 0.833 €/\$ is not equal to $E(X_1^{€/\$})$, which we computed directly, 0.9375 €/\$. The situation that $E(X_N^{\$/€})$ cannot be equal to $1/E(X_N^{€/\$})$ is known as *Siegel's paradox*. Siegel's paradox occurs because of a mathematical condition known as "Jensen's inequality," which implies that the "mean of a reciprocal is not equal to the reciprocal of a mean".[1]

Assume that the spot FX price of the euro is currently 0.90 \$/€. A year from now, there is a 50% chance that the spot FX price of the euro will be 0.75 \$/€ and a 50% chance that the spot FX price will be 1.10 \$/€. 1) What is the expected spot FX price of the euro a year from now? 2) What is the expected spot FX price of the US dollar a year from now? Show Siegel's paradox that your second answer is not the reciprocal of the first. Answers:

1) $E(X_1^{\$/€}) = 0.50(0.75\ \$/€) + 0.50(1.10\ \$/€) = 0.925\ \$/€$;

2) $E(X_1^{€/\$}) = 0.50[1/(0.75\ \$/€)] + 0.50[1/(1.10\ \$/€)] = 1.121\ €/\$$.

[1] Siegel's paradox was introduced in J. Siegel, "Risk, Interest Rates, and the Forward Exchange," *Quarterly Journal of Economics*, February, 1975.

The reciprocal of 1.121 €/$ is 0.892 $/€, not 0.925 $/€.

CORPORATE FX EXPOSURE

As you can see from Exhibit 1.3 and Figures 1.1 through 1.3, FX rates can fluctuate significantly. While a spot FX rate at the moment is known and observable, we do not know ahead of time what the future spot FX rate for any currency will be. Many try to predict and speculate, but there is always uncertainty about what an FX rate will be in the future. Some FX rates are more volatile than others, depending on supply and demand and whether a country tries to stabilize the currency.

The risk that future FX uncertainty poses to a company is determined by both how volatile the FX rate is and the company's *FX exposure*, i.e., the sensitivity of its financial results to FX changes. Later chapters go into FX exposure in detail; here we introduce the simplest type: *FX transaction exposure*, defined as uncertainty in the home currency value of a contracted foreign currency amount.

Assume that a US company has shipped products to Germany, and the terms call for payment six months from now in the amount of €3000. The US company's receivable may be referred to as a *natural long FX position* in euros, where the term "long" refers to an inflow (of euros) and the term "natural" means that the inflow is expected as part of the company's business operations. Since the spot $/€ FX rate six months from now is unknown at the present, the amount of US dollars that the euro receivable will ultimately provide is uncertain. For example, if in six months' time the spot FX rate is 0.96 $/€, the euro inflow will be worth €3000(0.96 $/€) = $2880. If instead the spot FX rate six months from now turns out to be 1.04 $/€, the euro inflow will be worth €3000(1.04 $/€) = $3120. Figure 1.4 depicts the long FX transaction exposure.

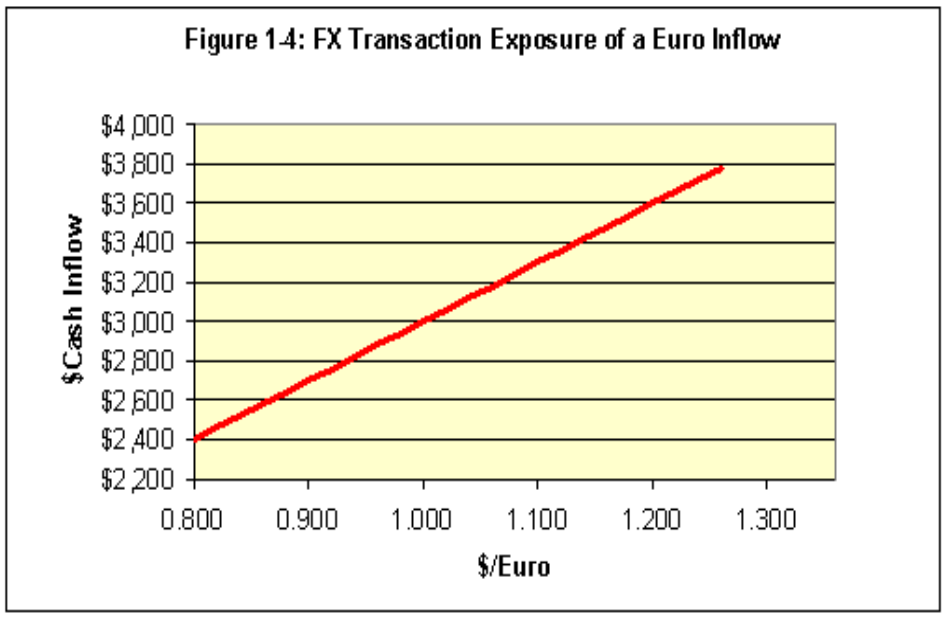


Figure 1.4 The natural long FX transaction exposure of a future receipt of €3000. If the spot FX rate is 1 $/€, the cash inflow will be worth $3000. If the spot FX rate is higher (e.g., 1.20 $/€), the cash inflow will be worth more

in US dollars (e.g., $3600).

FX transaction exposure may be similarly associated with a future payable of an amount of foreign currency that is owed on services received or contracted. Such a payable is called a *natural short FX position* in the foreign currency, where the term "short" refers to the fact that the situation involves an outflow (of euros). The higher the spot FX price of the foreign currency at the time the payment is made, the more base currency is necessary to make the payment, as shown in Figure 1.5. If a US company owes ¥100 million due a year from now, and the spot FX rate turns out to be 125 ¥/$, the US dollars owed will be $800,000. But if the FX price of the yen is higher a year from now, at say 120 ¥/$, the amount of US dollars owed will be higher, $833,333.

Keep in mind throughout the text that "long" and "short" do not refer to time. Instead, being "short X" means you owe X and "long X" means you own X or will be receiving X.

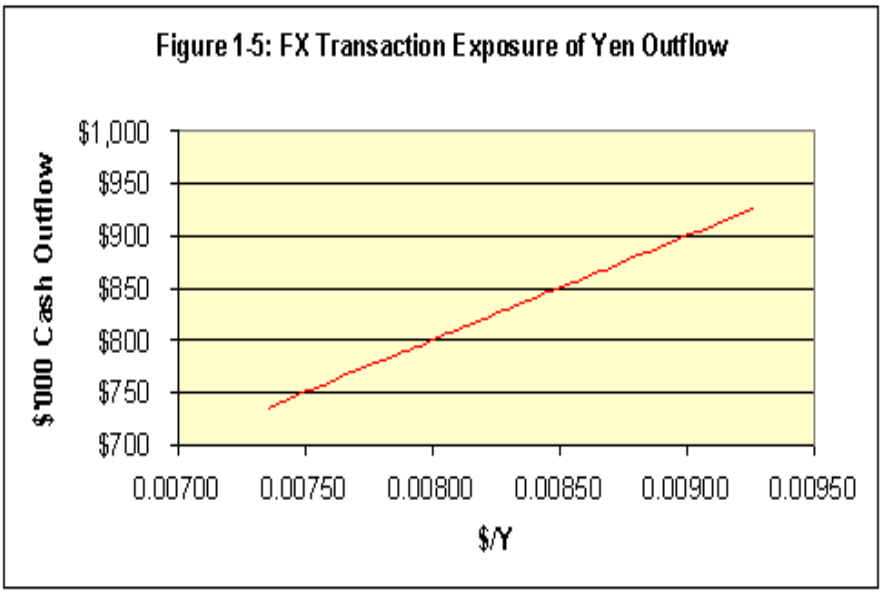


Figure 1.5 The natural short FX transaction exposure of a future payment of ¥1 million. If the spot FX rate is 125 ¥/$ (≡ to 0.008 $/¥), then the cash outflow will be require $800,000. If the spot FX price of the yen is higher a year from now, at say 120 ¥/$, the amount of US dollars owed will be higher, $833,333.

A US exporter has a Swiss franc receivable. If the Swiss franc depreciates in FX price between now and the due date of the receivable, will the exporter be fortunate or unfortunate?
Answer: *Unfortunate; the depreciation of the receivable currency implies fewer US dollars for the exporter.*

A US importer has a Japanese yen payable. If the US dollar depreciates in FX price (relative to the yen) between now and the due date of the payable, will the importer be fortunate or unfortunate?
Answer: *Unfortunate; the depreciation of the US dollar relative to the yen is an appreciation of the yen, and an appreciation of the payable currency implies that the importer will have to pay more US dollars.*

FX transaction exposure underlies the problem known as the *importer-exporter dilemma*. Either the importer or the exporter faces risk, depending on the currency in which traded goods are priced. Consider a Eurozone supplier of parts to a manufacturer in the United States. If the supplier sets its prices in euros, the US manufacturer faces the risk that the FX price of the euro will rise, making the imported parts more expensive. The US firm has a natural short FX transaction exposure to changes in the FX price of the euro. If prices are set in US dollars, the supplier faces the risk that the FX price of the euro will rise (the FX price of the US dollar will fall) and it will receive fewer euros for its parts. The supplier would have a natural long exposure to the FX price of the US dollar (in terms of euros).

A US manufacturer imports parts from a Eurozone supplier. When the spot FX price of the euro was 1 $/€, the companies agreed to a price of €3000 for the parts, payable when the parts were delivered a year later. Assume that one year later the spot FX price of the euro was 1.25 $/€. 1) What did the US firm expect to pay in US dollars based on the spot FX rate when the parts were ordered? What did the US firm actually pay? 2) If the price had instead been set at $3000, how many euros would the supplier have expected based on the spot FX rate at the time of the order, and how many would actually be received a year later?
Answers:
1) The US firm expects to pay $3000, but actually must pay €3000(1.25 $/€) = $3750.

2) The Eurozone firm expects to receive €3000, but actually receives $3000/(1.25 $/€) = €2400.

FUNDAMENTAL FX SUPPLY AND DEMAND

(drivers of exchange rates)

To see an example of an FX transaction in international trade, assume that Sam's Stores in the United States imports sweaters from Crown Materials Ltd. in England. Naturally, Sam's currency is the US dollar, while Crown's home currency is the British pound. Sam's

and Crown must agree on the currency in which the payment is to be made. If Sam's is to send payment in pounds, Sam's must first buy the pounds from a bank in exchange for US dollars. If Sam's is to send payment in US dollars, Crown will exchange those funds with a bank for pounds. (Note the importer-exporter dilemma: If the price of sweaters is fixed in pounds, Sam's will have a natural short exposure to the pound; if the price of sweaters is fixed in US dollars, Crown will have a natural long FX exposure to the US dollar.)

In either payment case, there is a *retail FX transaction* between a retail currency user and a bank. Crown's ultimate need for pounds to pay employees and other expenses means a demand in the FX market for pounds and a supply of US dollars. Unless there is a simultaneous source of demand elsewhere in the market for the US dollars being supplied, at the current spot FX rate, basic economics tells us that the imbalance between supply and demand will pressure the spot FX rate to change. In our example, US dollars are being sold for pounds due to a US import of British products. Thus, the spot FX price of pounds in US dollars should rise due to the selling pressure on the US dollar and the corresponding buying pressure on the pound. For example, if the spot FX rate starts at 1.50 $/£, an increase in the spot FX price of the pound would mean an increase in the spot FX rate to a number higher than 1.50 $/£, say, to 1.53 $/£. Alternatively, we may say that the FX price of the US dollar will decline relative to the pound.

Retail FX demand originates from other sources besides import/export trade. One example is *foreign direct investment (FDI)* of capital into overseas plant and equipment. A German company wishing to build a plant or buy a plant in Canada needs to exchange euros into Canadian dollars, i.e. buy Canadian dollars with euros, to make the investment.

Note that there is a self-stabilizing tendency in FX rates from the perspective of retail demand. If the FX price of the pound drops, other things equal, US importers are likely to buy more goods from producers in the United Kingdom. And UK importers are likely to buy fewer goods from US sources. This shift in demand should drive the FX rate in the opposite direction.

Another source of retail FX demand is *portfolio trading*, which applies to financial securities, rather than FDI in the form of physical capital. (Technically, the purchase of more than 10% of a company's equity by a foreign investor is classified as FDI rather than portfolio investment.) A Hong Kong manager of a bond portfolio wishing to invest in Japanese bonds needs to exchange Hong Kong dollars into yen to buy the bonds. Upon the liquidation of the bonds, the manager is likely to sell the yen back into Hong Kong dollars. A US company might borrow by selling yen-denominated bonds and FX the proceeds into US dollars to fund US dollar assets. This portfolio trade will cause pressure on the US dollar to appreciate relative to the yen.

Taken together, international trade, FDI, and portfolio trades are fundamental sources of supply and demand for FX transactions. In 2001, the volume of FX transactions for portfolio trades was $329 billion, while the volume of FX

transactions by corporate entities for both international trade and FDI was $156 billion. Between 1998 and 2001, the volume of FX trading by corporate entities dropped, as firms' treasury departments became more efficient in netting the FX trading internally. On the other hand, the volume of FX transactions for portfolio trades increased as international portfolio diversification increased.[2]

Another source of demand for some currencies is as a store of value. In general, nations whose economic policies have promoted economic growth and stability, and controlled inflation, will tend to have currencies that appreciate in price over currencies of countries with the opposite policies. The currencies of low inflation, growth oriented economies are referred to as ***hard currencies***, and the currencies of the weaker, high inflation economies are referred to as ***soft currencies***. There is an additional demand for hard currencies as a basic store of value for individuals, corporations, and governments in soft-currency countries. The US dollar, the Swiss franc, and the euro are the currencies in highest demand for this purpose. The increased demand for the euro for this purpose may be one reason the euro has appreciated in recent years.

INTERBANK FX MARKET

In either of the possible FX transactions in the Sam's/Crown example, a bank provides a retail customer with British pounds in return for US dollars. Unless the bank has an inventory of pounds, the bank itself needs to acquire the pounds for US dollars. One candidate is the country's central bank, the Federal Reserve (the Fed) for a US bank or the Bank of England for a UK bank. Another candidate is another bank anywhere in the world. Transactions between relatively large banks are said to take place in the wholesale ***interbank (FX) market***. If a bank is a small regional bank without direct trading access to the global interbank market, it may obtain currency from one of the larger interbank participants, possibly through one of a number of established FX brokers. An ***FX broker*** buys currency in the interbank market and, in turn, sells the currency at a markup to smaller players.

The interbank FX market operates globally, allowing a large number of banks and currency brokers of different nationalities to routinely exchange currencies with each other, with large corporations, and with large fund managers. The need for FX transactions is immense, and the vast interbank market has well over US $1 trillion worth of trades daily. Wholesale interbank FX trading between interbank dealers was about $689 billion in 2001. In the interbank market, no physical paper (banknotes or drafts) changes hands. All transactions take place electronically through an international clearing system. Generally, the FX market is unregulated.

[2] See "Review of the Foreign Exchange Market Structure," European Central Bank, March 2003: http://www.ecb.int/pub/pdf/fxmarketstructure200303.pdf.

CENTRAL BANKS AND BALANCE OF PAYMENTS

In addition to retail and interbank elements, other important participants in the FX market are ***central banks*** and ***speculators***. A country's central bank has an unlimited supply of its own country's currency. In addition, a central bank will maintain balances of *foreign currency reserves* *(or FX reserves)* of other currencies, obtained over time through transactions in the interbank market. In their FX reserves, central banks are like individuals in that they like to hold currencies that hold value. The US dollar, the Swiss franc, and the euro are prominent "reserve currencies".

To see how the central banks interact with the private market, say the Bank of England has routinely sold pounds to Crown Materials' bank for the US dollars originally sent by Sam's. The Bank of England can either hold the US dollars as FX reserves, or trade the US dollars back to the Fed for some of the Fed's existing FX reserves of British pounds (or for gold or other foreign currency).

If Sam's had acquired pounds from its US bank, which in turn had acquired the pounds from the Fed, the Fed would then be holding fewer pounds as part of the inventory of its FX reserves. If the Fed thought its new inventory level was too low, it could buy more pounds in the interbank market or from the Bank of England using gold or US dollars or, for that matter, any other country's currency. Note that if either of the central banks is in the transaction, there is an increase in the ***money supply*** of pounds, i.e., pounds circulating outside the central banking system, and a decline in the money supply of US dollars circulating outside the central bank system.

Whenever a country has a net outflow of currency (including gold), the country has a ***balance of payments deficit***. This means that the country's total purchases of foreign goods plus its investments into foreign assets exceed the total purchases of the country's goods by foreigners plus investments by foreigners in the country's assets. The result will be a reduction in the *net FX reserves* held by the country's central bank. The opposite is a ***balance of payments surplus***, with a corresponding gain of net FX reserves. If, over a given period of time, the value of all US purchases of British goods and investments is less than the value of British purchases of US goods and investment, the UK has a balance of payments (**BOP**) deficit versus the US. And the US has a BOP surplus versus its trading partner. These ideas are depicted in Figure 1.6.

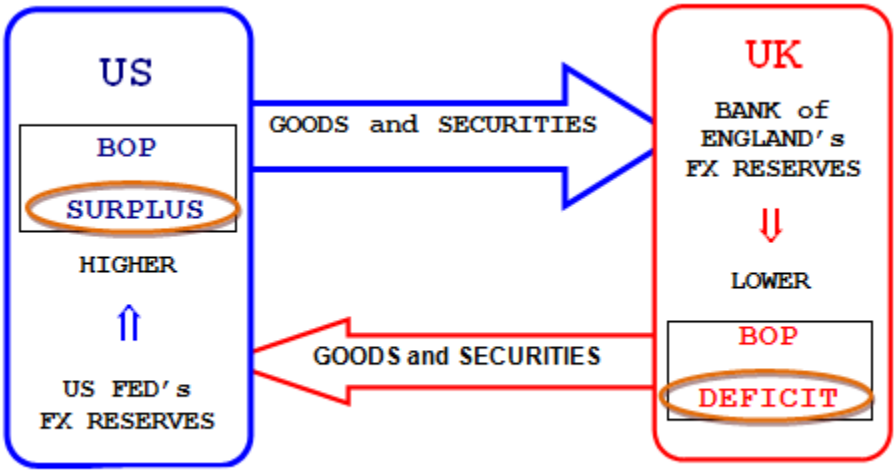


Figure 1.6 A balance of payments surplus for the United States and a balance of payments deficit for the United Kingdom. Britain's total of imports of goods from the United States and investments into the United States exceeds the US total

FIGURE 1.6, CROSS-BORDER FLOWS, BALANCE OF PAYMENTS, AND FX RESERVES

of imports from the United Kingdom and investments into the United Kingdom. The FX reserves held by the US Federal Reserve will increase and those held by the Bank of England decrease.

A *BOP deficit* tends to be accompanied by a drop in the FX price of the currency, since the currency is being sold to import goods and/or make overseas investments. Often it has been the case that the United States has had a deficit on trade (imports of goods higher than exports of goods), but a surplus on investment (more foreign investment into the United States than US investment abroad). In this situation, the overseas investment into the United States is said to be "*financing the trade deficit*" and helping to keep the US dollar from depreciating.[3]

The FX transactions of central banks are often routine, as in the example transfer of funds, but other times they are intended to implement economic policies. In these situations, central banks initiate transactions in the FX market that are large enough in size to have an influence on the FX rate. This activity is termed ***direct intervention***. The U.S. Treasury and Federal Reserve each have independent legal authority to directly intervene in the FX market.

In early 2004, a significant direct intervention was conducted by Japan. Japan was buying US dollars with Japanese yen to try to reduce the FX price of the yen. This intervention increased the yen money supply. Sometimes, a central bank will buy or sell long-term securities in the home currency to offset the change in the money supply caused by direct intervention. This process is known as ***sterilization***. **Sometimes, several central banks act in a coordinated manner to try to influence FX rates to achieve some multilateral policy goals reached by negotiation and compromise**.

Direct intervention by central banks may cause FX rates to differ from levels other than what the free market would establish, but is not the main determinant of FX rates, even when several central banks act in coordination. In fact, the trading volume of the central banks as a whole is very small compared to the overall currency market. Central banks influence FX rates, but can neither control the global FX market nor totally determine FX rates. Central banks are simply market participants, albeit major ones, in the essentially unregulated interbank FX market. In addition to direct intervention, central banks may influence FX rates through interest rate policy, which is covered in Chapter 5.

Sometimes the central bank of a less developed country tries to control the FX price of its currency too rigidly. If the currency is freely convertible, this can lead to a currency crisis. Sometimes a government of a less developed country restricts the convertibility of its currency and dictates an ***official FX rate***. If this happens, a free market for the currency may spring up. If the government tolerates this free market, it is called a ***parallel market***. If not, it is called a *black market*.

3 Information about balance of payments may be obtained from the U.S. Department of Commerce's Bureau of Economic Activity (BEA): http://www.bea.doc.gov/.

The ***Bank for International Settlements (BIS)*** is an international organization that fosters cooperation among central banks and other agencies in pursuit of monetary and financial stability. The BIS headquarters is in Basel, Switzerland. Established in 1930, the BIS is the world's oldest international financial organization. As its customers are central banks, the BIS does not accept deposits from, or provide financial services to, private individuals or corporate entities. The BIS makes international financial information available related to FX rates (http://www.bis.org/index.htm).

SPECULATORS AND INTRINSIC FX VALUE

Another important participant in the FX market is the ***speculator***, who tries to make money on a view about the future direction of FX rates. Naturally, speculators account for supply and demand pressure on FX rates, beyond that fundamentally coming from the retail arena and central banks. Typically, speculators are private operators or trader-dealers employed by financial institutions. George Soros is a private speculator who has received much publicity, particularly in connection with the Asian crisis of the late 1990s. The speculation activity by corporate entities is said to have declined substantially. On the other hand, it has become easier for private speculators to trade in the FX market, with sites like **FOREX.com**.

Speculators have sometimes tried to figure out when a central bank may be running low on its overall FX reserves, hence unable to defend its own currency in the FX market by using FX reserves to buy it. The speculators will then attack that currency by selling it in large quantity, hastening a crisis and profiting at the expense of one or more central banks. A history of central bank losses to speculators, culminating in a 1992 British pound crisis, may have been the reason central banks curtailed direct intervention in the FX market after 1992.

Some speculators are well informed while others are not. Well-informed speculators base their trading on good fundamental economic information. Well-informed speculators form an idea of how far an actual FX rate deviates from the intrinsic FX rate, i.e., the "true" or "correct" FX rate based on economic fundamentals. If the deviation of the actual FX rate from the intrinsic FX rate is large enough, well-informed speculators trade currencies to try to profit from this misalignment. Other speculators ignore fundamental FX values and trade currencies to try to profit by "***chasing trends***". Well-informed speculators trading on solid fundamental information should drive an actual FX rate toward its intrinsic FX value. Trading that is not based on good fundamental information, like trend chasing, may drive actual FX rates away from intrinsic FX values.

In Part II, we'll cover the idea of intrinsic FX values in more detail. In a truly ***efficient FX market***, the actual FX price of a currency and the intrinsic FX value would be the same. In reality, many believe that an actual FX rate oscillates around the intrinsic FX value, even though intrinsic FX value is difficult to assess. FX rates are sometimes described as having two components: there is a ***permanent component*** that is the intrinsic FX value; and there is a ***transitory component*** that is the deviation from intrinsic FX value.

GOLD AND FX RATES

The *gold standard* for the exchange of currencies began before there were any national currencies, when trade was conducted by barter. The first widely accepted medium of exchange was gold, and merchants began to judge the value of all other commodities in terms of ounces of gold.

At some point, the volume of business transactions outgrew the supply of gold available to serve as a medium of exchange. To solve this problem, those holding large quantities of gold became bankers, printing and circulating paper notes redeemable for gold. The gold notes became a convenient medium of exchange, and by lending gold to borrowers in the form of paper notes, more in gold notes were in circulation than was represented physically by the gold on hand in banks, "in reserve." Thus, quite a large volume of business transactions could be supported as if there were more gold on hand. The system worked, provided participants had confidence in banks to deliver gold against the notes on demand, and that not everyone tried to take physical delivery of gold at once.

Eventually, as paper money became nationalized, each country established a central bank to control its paper money supply. The system of paper notes expanded to checks and eventually to electronic balances, on the same principle as the gold reserve system: The physical supply of national paper money could be much lower than the amount circulated in the form of checks and electronic transfers. A bank, as part of a national financial system, is required to hold paper currency reserves and to provide paper money for deposit balances on demand, but the system is based on the notion that not everyone needs to hold the physical paper money at the same time.

Although it is now impractical, for some time banks were required to redeem paper money for gold on demand. Banks borrowed paper money from the central bank based upon gold deposits. Under this ***gold standard system***, the price at which a central bank would buy or sell gold to banks for paper money was a federal decision. In other words, a free market did not determine the price.

The fact that countries' central banks maintained set prices for gold in their national currencies generally dictated FX rates. For example, the United States might set a rate of $20 per ounce of gold, and the British a rate of £4 per ounce. As long as the two nations maintained these set prices for the redemption of gold, the spot FX rate between the national paper currencies (and thus deposit balances) was determined as 5 $/£.

Problems with the gold standard began in the chaotic time of the world wars and the Great Depression. National governments often devalued national currencies relative to gold trying to gain a trade advantage over others. For example, the British government might decide to value an ounce of gold at £5 per ounce instead of £4 per ounce. If the United States maintained a gold price of $20 per ounce, the spot FX price of the pound devalued to 4 $/£. After the devaluation, those in the United Kingdom holding pound balances now would find US products more expensive and would thus buy more at home. By the same

token, those in the United States would find British products less expensive and tend to import more from Britain. The British might want this result for two reasons: (1) the trade surplus added gold to the British national treasury, and (2) more jobs would be created in their country by the increase in overseas demand for the relatively inexpensive British products.

But the downside was that because people did not want to hold a currency if they thought it might be devalued, they tended to redeem for gold at that country's banks. Central banks of other countries would hold less of the currency as official FX reserves if there were some suspicion that a foreign central bank would close its gold window or devalue its currency by raising the official price for gold in terms of its own currency.

Eventually, the United States eliminated the national gold standard when it discontinued the redeemability of paper notes for gold. For a while, the US continued to maintain a fixed dollar price for gold for the settlement of international trade accounts and for purchase of gold from US citizens. This system, termed the *modified gold standard*, ended in the early 1970s when inflationary pressures forced the United States to quit backing the US dollar with gold, and the price of gold was allowed to find its free market value. Since the end of the gold standard, the world has relied on ***fiat money***, so-called because it is created by government fiat and backed only by the promises of central bankers to protect its value.

Gold has continued to be a means of settling international trade accounts between countries. If the United Kingdom has a balance of payments surplus with the United States, the Bank of England can then either hold the US dollars as official FX reserves or redeem them at the US Federal Reserve for gold (or for some of the Fed's official FX reserves of pounds). But many central banks have been reducing their gold reserves in recent years, since gold does not earn interest while foreign currency can be held in the form of interest-bearing securities.

For convenience and protection, many countries' gold reserves are stored in the vault at the New York Federal Reserve. The use of gold for balance of payment settlement often simply involves the movement of gold bars from one country's gold cubicle to another's.

*TRIANGULAR ARBITRAGE

Not significant. Probably not on exam.

Arbitrage is defined as the simultaneous purchase and sale of essentially the same good or security at different prices. When a cross-market exists and the direct cross-rate is different from the derived cross-rate, *triangular arbitrage* is theoretically possible in the FX market. For example, assume the cross-market's direct FX rate for yen/Swiss francs is 80 ¥/Sf at the same time that the yen trades at 125 ¥/$ and the Swiss franc trades at 1.50 Sf/$, implying the derived cross-rate of 83.33 ¥/Sf, found earlier. In this case, triangular arbitrage is possible. The FX price of the Swiss franc, in yen, is lower in the cross-market than in the indirect market using the US dollar as a vehicle.

Thus, remembering to "buy low and sell high," you should buy Swiss francs with yen directly (at 80 ¥/Sf) and simultaneously sell Swiss francs for yen indirectly (at 83.33 ¥/Sf) using the US dollar vehicle.

Selling Swiss francs for yen indirectly means selling Swiss francs for US dollars and then selling the US dollars for yen. For example, you take 80 yen to buy 1 Swiss franc directly; sell the 1 Swiss franc for US dollars to get Sf 1/(1.50 Sf/$) = $0.667; and then use $0.667 to buy yen at 125 ¥/$, to get $0.667(125 ¥/$) = ¥83.33. You start with ¥80 and end up with ¥83.33, for an arbitrage profit of ¥3.33.

Maybe this arbitrage will be easier to see if you start with US dollars. The key is that you want to take advantage of a mispricing and buy Swiss francs with yen directly. So the first step is to exchange the US dollars into yen. Say you start with $1 million and you exchange this amount into ¥125 million. With ¥125 million, you can directly buy Swiss francs: (¥125 million)/(80 ¥/Sf) = Sf 1.5625 million. With Sf 1.5625 million, you can buy (Sf 1.5625 million)/(1.50 Sf/$) = $1,041,667. Your arbitrage profit from these hypothetical transactions is $41,667. Figure 1.7 depicts this strategy.

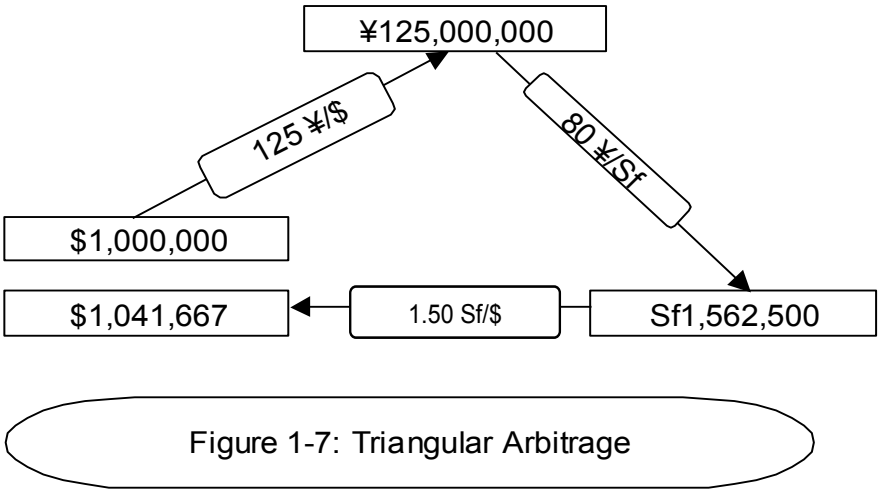


Figure 1-7: Triangular Arbitrage

Figure 1.7 Hypothetical example of how $41,667 of triangular arbitrage profit would be possible if one starts with $1 million and can make FX trades at 125 ¥/$, 80 ¥/Sf, and 1.50 Sf/$.

The potential for triangular arbitrage will tend to enforce the alignment of direct cross-rates with derived cross-rates. In the previous Swiss franc-yen arbitrage example, the direct purchase of Swiss francs with yen in the cross-market will, other things equal, cause the FX price of the Swiss franc (in yen) to appreciate to an FX price higher than 80 ¥/Sf. By the same token, the sale of Swiss francs for US dollars and the purchase of yen with US dollars in the indirect vehicle approach will tend to drive down the FX price of the Swiss franc in US dollars and drive up the FX price of the yen in US dollars. This activity results in a lower derived cross-market FX price of the Swiss franc (in yen) than 83.33 ¥/Sf.

Arbitrage activity is likely to continue until the direct cross-rate and the derived cross-rate have converged, at which point no further arbitrage is possible. In reality, the potential for profits from triangular arbitrage results in the situation where not such profits are possible.

Exhibit 1.5 shows some bid-ask FX rates reported on Yahoo on November 15, 2003. At a bid rate, you can buy the numerator currency with the denominator currency. At an ask rate, you can buy the denominator currency with the numerator currency.

Exhibit 1.5

Yahoo FX Quotes, November 15, 2003

	¥/$	¥/Sf	Sf/$
Bid	108.00	81.3862	1.3267
Ask	108.12	81.4954	1.3273

Exhibit 1.5 shows real world spot bid-ask FX quotes observed on Yahoo on November 15, 2003.

***Bid*: The price at which the numerator currency may be purchased with the denominator currency.**

***Ask*: The price at which the denominator currency may be purchased with the numerator currency.**

We can show that there are no triangular arbitrage opportunities in the real-world quotes in Exhibit 1.5. Let us say that you start with $1 million. You first buy Sf 1.3267 million. With the Sf 1.3267 million, you then buy yen, (81.3862 ¥/Sf)(Sf 1.3267 million) = ¥107.975 million. With ¥107.975 million, you buy US dollars, obtaining (¥107.975 million)/(108.12 ¥/$) = $998,660. You lose $1 million – 998,660 = $1340 with these transactions. This scenario is depicted in Figure 1.8. The next example demonstrates that you would also lose money by going the other route of first buying yen, then Swiss francs, and finally US dollars.

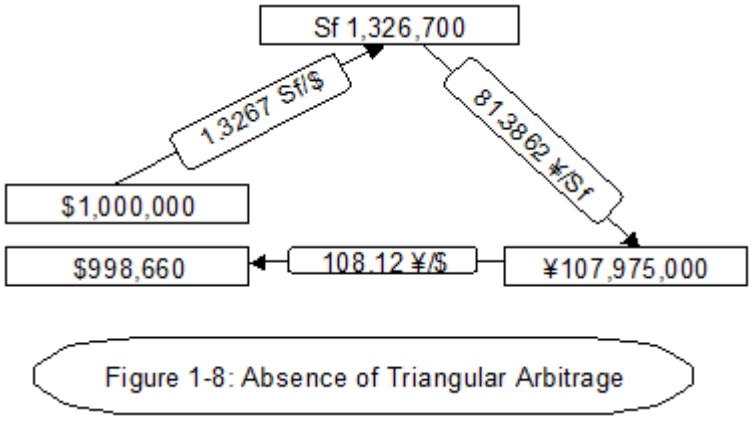


Figure 1.8 Illustration that triangular arbitrage profits are not possible with the real world bid-ask FX quotes of Exhibit 1.5.

Start with $1 million. Use the bid-ask quotes in Exhibit 1.5 to buy yen, then buy Swiss francs, then buy US dollars. What is your loss?
***Answer**: You buy ¥108 million.*
With this amount, you buy (¥108 million)/(81.4954 ¥/Sf) = Sf 1.3252 million.
With this amount, you buy (Sf 1.3252 million)/(1.3273 Sf/$) = $998,439.
Your loss is $1 million – 998,439 = $1561.

The examples with the FX quotes in Exhibit 1.5 show that triangular arbitrage opportunities do not generally exist in the real world when bid-ask spreads are considered. In the real world, only professional FX traders would have access to the small triangular arbitrage opportunities that temporarily occur. The buying and selling by professional traders pressures the opportunities away as the professionals capture the profits.

For non-professional traders, triangular arbitrage is thus only an instructional concept that is helpful in understanding the implications of the absence of triangular arbitrage opportunities. For example, suppose that we observe FX rates of 1.60 $/£ and 1.15 $/€, and thus we know that the FX rate between pounds and euros should be (1.15 $/€)/(1.60 $/£) = 0.71875 £/€. If the euro depreciates relative to the US dollar to 1 $/€, but the euro/pound FX rate does not change, it must be the case that the pound also depreciates relative to the US dollar to (1 $/€)/(0.71875 £/€) = 1.391 $/£. This example demonstrates a unilateral appreciation the FX price of the US dollar relative to the other currencies, perhaps driven by some economic development in the United States. The next example demonstrates a unilateral depreciation in the FX price of the euro relative to the other currencies, driven perhaps by some economic development in the Eurozone.

We observe FX rates of 1.60 $/£ and 1.15 $/€, so we know that the FX rate between pounds and euros must be 0.71875 £/€. If the euro depreciates relative to the US dollar to 1 $/€, but the US dollar/pound FX rate does not change, what must the new pound/euro FX rate be?
***Answer:** (1 $/€)/(1.60 $/£) = 0.625 £/€.*

SUMMARY

This chapter introduces the general subject of foreign exchange (FX) rates and the FX market. An FX rate is the price of one currency in terms of another. The $/€ FX rate is the FX price of the euro in terms of the US dollar, and the ¥/$ FX rate in FX price of the US dollar in terms of yen.

The FX price of the euro in terms of the US dollar is the mathematical reciprocal of the FX price of the US dollar in terms of the euro. However, the expected FX price of the euro in terms of the US dollar is *not* the mathematical reciprocal of the FX price of the US dollar in terms of the euro, a situation known as Siegel's paradox.

FX rates fluctuate with supply and demand pressures, just like stock prices. The volatility of FX rates creates a risk for many companies. The impact of the risk posed by fluctuating FX rates was introduced in the discussion of FX transaction exposure.

We discussed the basic supply and demand forces that cause FX rates to fluctuate, including the activities of central banks and speculators. The discussion covered the relationship between FX rates and the balance of payments. The historical role of gold in determining FX rates was reviewed.

Finally, we covered the topic of triangular arbitrage. Given the Sf/$ and ¥/$ FX rates, there is an implied FX cross-rate between Swiss francs and yen. If the actual FX cross-rate differs from the indirect FX cross-rate, an arbitrage profit is possible in principle. But since many currency traders are constantly searching for such arbitrage possibilities, the FX rates stay very well aligned, especially from the point of view of those of us who are not currency traders with the lowest transaction costs.

GLOSSARY

American Terms: An FX rate quotation expressed as US dollars per one unit of another currency.

Arbitrage: The simultaneous purchase and sale of essentially the same good or security at different prices.

Balance of Payments Deficit (Surplus): A country in this condition has a net outflow (inflow) of currency, including gold.

Bank for International Settlements (BIS): An international organization that fosters cooperation among central banks and other agencies in pursuit of monetary and financial stability.

Black Market: Illegal trading in a currency that has an official FX rate dictated by the country's government.

Cross-Market: A market for direct exchange of two non-US dollar currencies.

Cross-Rate: An FX rate between two non-US dollar currencies.

Devaluation: A decline in the FX price of a currency brought about by official policy.

Direct Intervention: The purchase and sale of currencies by central banks to influence FX rates.

Direct Terms: An FX rate expressed as the amount of one's home currency price per one unit of a foreign currency.

Efficient FX Market: An ideal where actual FX rates are equal to the intrinsic FX values.

European Terms: An FX rate quotation expressed as the number of units of a currency per one US dollar.

Foreign Currency Reserves (or FX Reserves)*:* Holdings by a central bank in various currencies to facilitate international settlements and provide backing for its own currency.

Foreign Exchange (FX) Rate: The price of one currency in terms of another.

Foreign Direct Investment (FDI): Investment into plant and subsidiaries in a foreign country, as distinct from international portfolio investment in securities.

FX Broker: One who buys currency in the interbank market and, in turn, sells the currency at a markup to smaller players.

FX Exposure: The risk that future FX uncertainty poses to the financial results of a company.

FX Transaction Exposure: The uncertainty in the home currency value of a contracted foreign currency amount.

Hard Currency: A currency that holds its value because the country's economy is strong and growing, and not experiencing severe inflation and economic deterioration.

Importer-Exporter Dilemma: An FX exposure problem, caused by uncertain FX rates, for firms doing business in international markets. Either the importer or the exporter faces risk, depending on the currency in which traded goods are priced.

Indirect Terms: An FX rate expressed as the amount of foreign currency per one unit of one's base currency price.

Interbank (FX) Market: The wholesale international market for currency trading between major banks and financial institutions around the world.

Natural Long (Short) FX Position: An inflow (outflow) of a currency is expected as part of the company's natural business.

Official FX Rate: An FX rate sometimes dictated by the government of a less developed country whose currency is not freely convertible.

Parallel Market: Trading in a currency that is tolerated by a government that has dictated an official FX rate.

Portfolio Investment: Investments in financial securities such as stocks, bonds as distinct from foreign direct investment.

Retail (FX) Market: The market for currency exchange between banks and retail businesses and investment portfolios.

Revaluation: An increase in the FX price of a currency brought about by official policy.

Siegel's Paradox: The mathematical result that the expected future spot FX price of currency A relative to currency B is not equal to the reciprocal of the expected future spot FX price of currency B relative to currency A.

Soft Currency: A currency that loses value because the country's economy is weak and experiencing inflation.

Spot FX Rate: Exchange rate for immediate delivery.

Sterilization: A central bank's purchase or sale of long-term securities in the home currency to offset the change in the money supply caused by direct intervention.

Triangular Arbitrage: The strategy to exploit the difference between a direct cross-rate and a derived cross-rate.