# International Corporate Finance 20

## OPENING CASE

In October 2011, the yen had reached 75.72 yen per dollar, the strongest yen in recent years. While a strong currency sounds good, it creates problems for exporters by making their products more expensive. Because the Japanese economy is in large part based on exports, businesses began to worry. For example, Toyota says that a single yen change against the U.S. dollar over a full year changed its operating profit by ¥40 billion ($369 million). For Nissan and Honda, the operating profit changes are ¥20 billion ($184 million) and ¥16 billion ($148 million), respectively. In an effort to aid exporters, the Japanese government moved to weaken the yen, which reached 125 yen per dollar in 2015.

On the downside, a weaker yen increases energy prices because Japan imports much of its energy needs. Executives were worried that the weakening of the yen could go too far, eroding confidence in both Japan and the yen. In this chapter, we explore the important role played by currencies and exchange rates in international finance, along with a number of other key topics.

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Corporations with significant foreign operations are often called *international corporations* or *multinationals*. Such corporations must consider many financial factors that do not directly affect purely domestic firms. These include foreign exchange rates, differing interest rates from country to country, complex accounting methods for foreign operations, foreign tax rates, and foreign government intervention.

The basic principles of corporate finance still apply to international corporations; like domestic companies, these firms seek to invest in projects that create more value for the shareholders than they cost and to arrange financing that raises cash at the lowest possible cost. In other words, the net present value principle holds for both foreign and domestic operations, although it is usually more complicated to apply the NPV rule to foreign investments.

One of the most significant complications of international finance is foreign exchange. The foreign exchange markets provide important information and opportunities for an international corporation when it undertakes capital budgeting and financing decisions. As we will discuss, international

exchange rates, interest rates, and inflation rates are closely related. We will spend much of this chapter exploring the connection between these financial variables.

We won't have much to say here about the role of cultural and social differences in international business. Neither will we be discussing the implications of differing political and economic systems. These factors are of great importance to international businesses, but it would take another book to do them justice. Consequently, we will focus only on some purely financial considerations in international finance and some key aspects of foreign exchange markets.

# 20.1 TERMINOLOGY

A common buzzword for the student of business finance is *globalization*. The first step in learning about the globalization of financial markets is to conquer the new vocabulary. As with any specialty, international finance is rich in jargon. Accordingly, we get started on the subject with a highly eclectic vocabulary exercise.

The terms that follow are presented alphabetically, and they are not all of equal importance. We choose these particular ones because they appear frequently in the financial press or because they illustrate the colorful nature of the language of international finance.

See www.adr.com for more on ADRs.

1. An **American Depositary Receipt (ADR)** is a security issued in the United States that represents shares of a foreign stock, allowing that stock to be traded in the United States. Foreign companies use ADRs, which are issued in U.S. dollars, to expand the pool of potential U.S. investors. ADRs are available in two forms for a large and growing number of foreign companies: company sponsored, which are listed on an exchange, and unsponsored, which usually are held by the investment bank that makes a market in the ADR. Both forms are available to individual investors, but only company-sponsored issues are quoted daily in newspapers.
2. The **cross-rate** is the implicit exchange rate between two currencies (usually non-U.S.) when both are quoted in some third currency, usually the U.S. dollar.
3. A **Eurobond** is a bond issued in multiple countries but denominated in a single currency, usually the issuer's home currency. Such bonds have become an important way to raise capital for many international companies and governments. Eurobonds are issued outside the restrictions that apply to domestic offerings and are syndicated and traded mostly from London. However, trading can and does take place anywhere there is a buyer and a seller.
4. **Eurocurrency** is money deposited in a financial center outside of the country whose currency is involved. For instance, Eurodollars—the most widely used Eurocurrency—are U.S. dollars deposited in banks outside the U.S. banking system.
5. **Foreign bonds**, unlike Eurobonds, are issued in a single country and are usually denominated in that country's currency. Often, the country in which these bonds are issued will draw distinctions between them and bonds issued by domestic issuers, including different tax laws, restrictions on the amount issued, and tougher disclosure rules.

   Foreign bonds often are nicknamed for the country where they are issued: Yankee bonds (United States), samurai bonds (Japan), Rembrandt bonds (the Netherlands), bulldog bonds (Britain), and dim sum bonds (yuan-denominated bonds issued in Hong Kong). Partly because of tougher regulations and disclosure requirements, the foreign bond market hasn't grown in past years with the vigor of the Eurobond market.

6. **Gilts**, technically, are British and Irish government securities, although the term also includes issues of local British authorities and some overseas public sector offerings.

> For current LIBOR rates, see www.bloomberg.com.

7. The **London Interbank Offered Rate (LIBOR)** is the rate that most international banks charge one another for loans of Eurodollars overnight in the London market. LIBOR is a cornerstone in the pricing of money market issues and other short-term debt issues by both government and corporate borrowers. Interest rates are frequently quoted as some spread over LIBOR, and they then float with the LIBOR rate.

There are two basic kinds of **swaps**: interest rate and currency. An interest rate swap occurs when two parties exchange a floating-rate payment for a fixed-rate payment or vice versa. Currency swaps are agreements to deliver one currency in exchange for another. Often, both types of swaps are used in the same transaction when debt denominated in different currencies is swapped. page 620

# 20.2 FOREIGN EXCHANGE MARKETS AND EXCHANGE RATES

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The **foreign exchange market** is undoubtedly the world's largest financial market. It is the market where one country's currency is traded for another's. Most of the trading takes place in a few currencies: the U.S. dollar ($), the British pound sterling (£), the Japanese yen (¥), and the euro (€). Table 20.1 lists some of the more common currencies and their symbols.

**TABLE 20.1** International Currency Symbols

| COUNTRY | CURRENCY | SYMBOL |
|---|---|---|
| Australia | Dollar | A$ |
| Canada | Dollar | Can$ |
| Denmark | Krone | DKr |
| EMU* | Euro | € |
| India | Rupee | RS |
| Iran | Rial | RI |
| Japan | Yen | ¥ |
| Kuwait | Dinar | KD |
| Mexico | Peso | Ps |
| Norway | Krone | NKr |
| Saudi Arabia | Riyal | SR |
| Singapore | Dollar | S$ |
| South Africa | Rand | R |
| Sweden | Krona | SKr |
| Switzerland | Franc | Fr |
| United Kingdom | Pound | £ |

| | | |
|---|---|---|
| United States | Dollar | $ |

*European Economic and Monetary Union.

The foreign exchange market is an over-the-counter market, so there is no single location where traders get together. Instead, market participants are located in the major commercial and investment banks around the world. They communicate using computer terminals, telephones, and other telecommunications devices. For example, one communications network for foreign transactions is maintained by the Society for Worldwide Interbank Financial Telecommunication (SWIFT), a Belgian not-for-profit cooperative. Using data transmission lines, a bank in New York can send messages to a bank in London via SWIFT regional processing centers.

The many different types of participants in the foreign exchange market include the following:

Visit SWIFT at www.swift.com.

1. Importers who pay for goods using foreign currencies.
2. Exporters who receive foreign currency and may want to convert to the domestic currency.

Portfolio managers who buy or sell foreign stocks and bonds. page 621

4. Foreign exchange brokers who match buy and sell orders.
5. Traders who "make a market" in foreign currencies.
6. Speculators who try to profit from changes in exchange rates.

## Exchange Rates

An **exchange rate** is simply the price of one country's currency expressed in terms of another country's currency. In practice, almost all trading of currencies takes place in terms of the U.S. dollar. For example, both the Swiss franc and the Japanese yen are traded with their prices quoted in U.S. dollars. Exchange rates are constantly changing.

**EXCHANGE RATE QUOTATIONS** Figure 20.1 reproduces exchange rate quotations as they appeared in *The Wall Street Journal* in 2014. The first column (labeled "in USD equiv") gives the number of dollars it takes to buy one unit of foreign currency. Because this is the price in dollars of a foreign currency, it is called a *direct* or *American quote* (remember that "Americans are direct"). For example, the Australian dollar is quoted at .8507, which means that you can buy one Australian dollar with U.S. $.8507.

**FIGURE 20.1**
Exchange Rate Quotations

| Country/currency | USD equiv | Currency per USD | US$ vs. YTD % chg |
|---|---|---|---|
| **Americas** | | | |
| Argentina peso | .1173 | 8.5280 | 30.8 |
| Brazil real | .3897 | 2.5658 | 8.6 |
| Canada dollar | .8759 | 1.1417 | 7.5 |
| Chile peso | .001642 | 609.1000 | 15.8 |
| Colombia peso | .0004511 | 2217 | 14.9 |
| Ecuador US dollar | 1 | 1 | unch |
| Mexico peso | .0718 | 13.9334 | 6.8 |
| Peru new sol | .3424 | 2.9210 | 4.2 |
| Uruguay peso | .04247 | 23.545 | 11.1 |
| Venezuela b. fuerte | .15748031 | 6.3500 | unch |
| **Asia-Pacific** | | | |
| Australian dollar | .8507 | 1.1755 | 4.8 |
| 1-mos forward | .8489 | 1.1780 | 4.6 |
| 3-mos forward | .8452 | 1.1831 | 4.6 |
| 6-mos forward | .8397 | 1.1909 | 4.7 |
| China yuan | .1628 | 6.1431 | 1.4 |
| Hong Kong dollar | .129 | 7.7546 | unch |
| India rupee | .01606 | 62.25095 | .6 |
| Indonesia rupiah | .0000817 | 12246 | .7 |
| Japan yen | .00843 | 118.62 | 12.6 |
| 1-mos forward | .00844 | 118.54 | 11.2 |
| 3-mos forward | .00844 | 118.49 | 11.2 |
| 6-mos forward | .00845 | 118.37 | 11.1 |
| Malaysia ringgit | .2951 | 3.3887 | 3.2 |
| New Zealand dollar | .7843 | 1.2750 | 4.8 |
| Pakistan rupee | .00982 | 101.805 | −3.4 |
| Philippines peso | .0223 | 44.905 | 1.2 |
| Singapore dollar | .7667 | 1.3043 | 3.3 |
| South Korea won | .0008983 | 1113.2 | 5.4 |
| Taiwan dollar | .03226 | 30.999 | 3.6 |
| Thailand baht | .03045 | 32.843 | .4 |
| Vietnam dong | .00005 | 21355 | 1.1 |

| Country/currency | USD equiv | Currency per USD | US$ vs. YTD % chg |
|---|---|---|---|
| **Europe** | | | |
| Czech Rep. koruna | .04507 | 22.188 | 11.6 |
| Denmark krone | .1673 | 5.9757 | 10.1 |
| Euro area euro | 1.2452 | .8031 | 10.4 |
| Hungary forint | .00406209 | 246.1800 | 13.9 |
| Norway krone | .1422 | 7.0305 | 15.8 |
| Poland zloty | .2976 | 3.3598 | 11.1 |
| Romania leu | .2808 | 3.5617 | 9.5 |
| Russia ruble | .01989 | 50.274 | 52.7 |
| Sweden krona | .1342 | 7.4518 | 15.8 |
| Switzerland franc | 1.0357 | .9655 | 8.1 |
| 1-mos forward | 1.0362 | .9651 | 7.5 |
| 3-mos forward | 1.0369 | .9644 | 7.5 |
| 6-mos forward | 1.0382 | .9632 | 7.4 |
| Turkey lira | .4505 | 2.2200 | 3.3 |
| UK pound | 1.5649 | .6390 | 5.8 |
| 1-mos forward | 1.5646 | .6391 | 5.5 |
| 3-mos forward | 1.5639 | .6394 | 5.5 |
| 6-mos forward | 1.5626 | .6400 | 5.5 |
| **Middle East/Africa** | | | |
| Bahrain dinar | 2.6516 | .3771 | unch |
| Egypt pound | .1399 | 7.1471 | 2.8 |
| Israel shekel | .2567 | 3.8950 | 12.3 |
| Jordan dinar | 1.4187 | .7049 | −.4 |
| Kenya shilling | .01109 | 90.149 | 4.3 |
| Kuwait dinar | 3.429 | .2916 | 3.3 |
| Lebanon pound | .0006612 | 1512.45 | .5 |
| Saudi Arabia riyal | .2665 | 3.7529 | .1 |
| South Africa rand | .0903 | 11.0695 | 5.5 |
| UAE dirham | .2723 | 3.6731 | unch |

Get up-to-the minute exchange rates at www.xe.com and www.exchangerate.com.

The second column shows the *indirect*, or *European, exchange rate* (even though the currency may not be European). This is the amount of foreign currency per U.S. dollar. The Australian dollar is quoted here at 1.1755, so you can get 1.1755 Australian dollars for one U.S. dollar. Naturally, this second exchange rate is just the reciprocal of the first one (possibly with a small rounding error), 1/.8507 = 1.1755.

You can also find exchange rates on a number of websites. Suppose you have just returned from your dream vacation to Jamaica and feel rich since you have 10,000 Jamaican dollars left over. You now need to convert these to U.S. dollars. How much will you have?

We went to www.xe.com and used the currency converter on the site to find out. This is what we found: page 622

10,000.00 JMD = 81.8641 USD

Jamaican Dollar ↔ US Dollar

1 JMD = 0.00818641 USD 1 USD = 122.154 JMD

Mid-market rates: 2016-04-21 18:27 UTC

Looks like you left Jamaica just before you ran out of money.

**EXAMPLE 20.1**

**A Yen for Euros**

Suppose you have $1,000. Based on the rates in Figure 20.1, how many Japanese yen can you get? Alternatively, if a Porsche costs €100,000 (recall that € is the symbol for the euro), how many dollars will you need to buy it?

The exchange rate in terms of yen per dollar (second column) is 118.62. Your $1,000 will thus get you:

$1,000 × 118.62 yen per $1 = 118,620 yen

Because the exchange rate in terms of dollars per euro (first column) is 1.2452, you will need:

€100,000 × $1.2452 per € = $124,520

**CROSS-RATES AND TRIANGLE ARBITRAGE** Using the U.S. dollar as the common denominator in quoting exchange rates greatly reduces the number of possible cross-currency quotes. For example, with five major currencies, there would potentially be 10 exchange rates instead of just four.[1] Also, the fact that the dollar is used throughout cuts down on inconsistencies in the exchange rate quotations.

Earlier, we defined the cross-rate as the exchange rate for a non-U.S. currency expressed in terms of another non-U.S. currency. For example, suppose we observe the following for the euro (€) and the Swiss franc (Fr):

**€ per $1 = 1.00**

**Fr per $1 = 2.00**

Suppose the cross-rate is quoted as:

**€ per Fr = .40**

What do you think?

The cross-rate here is inconsistent with the exchange rates. To see this, suppose you have $100. If you convert this to Swiss francs, you will receive:

**$100 × Fr 2 per $1 = Fr 200**

If you convert this to euros at the cross-rate, you will have:

**Fr 200 × €.4 per Fr 1 = € 80**

However, if you just convert your dollars to euros without going through Swiss francs, you will have:

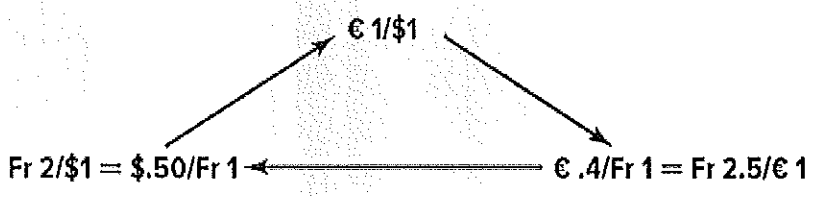
**$100 × €1 per $1 = € 100**

What we see is that the euro has two prices, €1 per $1 and €.80 per $1, with the price we pay depending on how we get the euros.

To make money, we want to buy low and sell high. The important thing to note is that euros are cheaper if you buy them with dollars because you get 1 euro instead of just .8. You should proceed as follows:

1. Buy 100 euros for $100.
2. Use the 100 euros to buy Swiss francs at the cross-rate. Because it takes .4 euros to buy a Swiss franc, you will receive €100/.4 = Fr 250.
3. Use the Fr 250 to buy dollars. Because the exchange rate is Fr 2 per dollar, you receive Fr 250/2 = $125, for a round-trip profit of $25.
4. Repeat Steps 1 through 3.

This particular activity is called *triangle arbitrage* because the arbitrage involves moving through three different exchange rates:




To prevent such opportunities, it is not difficult to see that because a dollar will buy you either 1 euro or 2 Swiss francs, the cross-rate must be:

**(€1/$1)/(Fr 2/$1) = €1/Fr 2**

That is, the cross-rate must be 1 euro per 2 Swiss francs. If it were anything else, there would be a triangle arbitrage opportunity.

## EXAMPLE 20.2

### Shedding Some Pounds

Suppose the exchange rates for the British pound and Swiss franc are:

Pounds per $1 = .60

Fr per $1 = 2.00

The cross-rate is three francs per pound. Is this consistent? Explain how to go about making some money.

The cross-rate should be Fr 2.00/£.60 = Fr 3.33 per pound. You can buy a pound for Fr 3 in one market, and you can sell a pound for Fr 3.33 in another. So we want to first get some francs, then use the francs to buy some pounds, and then sell the pounds. Assuming you have $100, you could:

1. Exchange dollars for francs: $100 × 2 = Fr 200.
2. Exchange francs for pounds: Fr 200/3 = £66.67.
3. Exchange pounds for dollars: £66.67/.60 = $111.11.

This would result in an $11.11 round-trip profit.

For international news and events, visit www.ft.com.

**Types of Transactions** There are two basic types of trades in the foreign exchange market: spot trades and forward trades. A **spot trade** is an agreement to exchange currency "on the spot," which actually means that the transaction will be completed or settled within two business days. The exchange rate on a spot trade is called the

reasons given was the currency advantage. Executives felt that manufacturing with costs in Mexican pesos would minimize the cost of the automobiles. A nearby *Finance Matters* box explores a famous example of PPP violations. page 626

# FINANCE MATTERS

## McPRICING

As we discussed in the chapter, the idea of absolute purchasing power parity (PPP) does not seem to hold in practice. One of the more famous violations of absolute PPP is the Big Mac index constructed by *The Economist*. To construct the index, prices for a Big Mac in different countries are gathered from McDonald's. We went to www.economist.com to find the January 2016 Big Mac index (we will leave it to you to find the most recent index or check our blog for updates).

According to the index on that day, absolute PPP does not seem to hold, at least for the Big Mac. In fact, in only 2 of the 43 currencies surveyed by *The Economist* is the exchange rate within 10 percent of that predicted by absolute PPP. The largest disparity was in Venezuela, where the currency was apparently undervalued by 87 percent. And 21 of the 43 currencies were "incorrectly" priced by more than 40 percent. Why?

There are several reasons. First, a Big Mac is not really transportable. Yes, you can load a ship with Big Macs and send it to a country where the currency is supposedly overvalued. But do you really think people would buy your Big Macs? Probably not. Even though it is relatively easy to transport a Big Mac, it would be relatively expensive, and the hamburger would suffer in quality along the way.

Also, if you look, the price of the Big Mac is the average of the prices from five cities. The reason is that the Big Mac does not sell for the same price in different areas of the United States, where presumably they are all purchased with the dollar. The cost of living and competition are only a few of the factors that affect the price of a Big Mac in the United States. Since Big Macs are not priced the same in the same country and currency, would we expect absolute PPP to hold across currencies?

Finally, differing tastes can also account for the apparent discrepancy. In the United States, hamburgers and fast food have become staples of the American diet. In other countries, hamburgers have not become as entrenched. We would expect the price of the Big Mac to be lower in the United States since there is much more competition.

Having examined Big Mac prices, we should say that absolute PPP should hold more closely for more readily transportable items. For instance, there are many companies with stock listed on both the NYSE and the stock exchange of another country. If you examine the share prices on the two exchanges you will find that the price of the stock is almost exactly what absolute PPP would predict. The reason is that a share of stock in a particular company is (usually) the same wherever you buy it and whatever currency is used.

## Relative Purchasing Power Parity

As a practical matter, a relative version of purchasing power parity has evolved. *Relative purchasing power parity* does not tell us what determines the absolute level of the exchange rate. Instead, it tells us what determines the *change* in the exchange rate over time.

**THE BASIC IDEA** Suppose the British pound–U.S. dollar exchange rate is currently $S_0$ = £.50. Further suppose that the inflation rate in Britain is predicted to be 10 percent over the coming year, and (for the moment) the inflation rate in the United States is predicted to be zero. What do you think the exchange rate will be in a year?

If you think about it, you see that a dollar currently costs .50 pounds in Britain. With 10 percent inflation, we expect prices in Britain to generally rise by 10 percent. So we expect that the price of a dollar will go up by 10 percent, and the exchange rate should rise to £.50 × 1.1 = £.55.

If the inflation rate in the United States is not zero, then we need to worry about the *relative* inflation rates in the two countries. For example, suppose the U.S. inflation rate is predicted to be 4 percent. Relative to prices in the United States, prices in Britain are rising

at a rate of 10 percent − 4 percent = 6 percent per year. So we expect the price of the dollar to rise by 6 percent, and the predicted exchange rate is £.50 × 1.06 = £.53. page 627

**THE RESULT** In general, relative PPP says that the change in the exchange rate is determined by the difference in the inflation rates of the two countries. To be more specific, we will use the following notation:

$S_0$ = Current (Time 0) spot exchange rate (foreign currency per dollar)
$E(S_t)$ = Expected exchange rate in $t$ periods
$h_{US}$ = Inflation rate in the United States
$h_{FC}$ = Foreign country inflation rate

Based on our discussion just preceding, relative PPP says that the expected percentage change in the exchange rate over the next year, $[E(S_1) - S_0]/S_0$, is:

$$[E(S_1) - S_0]/S_0 \cong h_{FC} - h_{US} \quad [20.1]$$

In words, relative PPP simply says that the expected percentage change in the exchange rate is equal to the difference in inflation rates.[2] If we rearrange this slightly, we get:

$$E(S_1) \cong S_0 \times [1 + (h_{FC} - h_{US})] \quad [20.2]$$

This result makes a certain amount of sense, but care must be used in quoting the exchange rate.

In our example involving Britain and the United States, relative PPP tells us that the exchange rate will rise by $h_{FC} - h_{US}$ = 10 percent − 4 percent = 6 percent per year. Assuming the difference in inflation rates doesn't change, the expected exchange rate in two years, $E(S_2)$, will therefore be:

$$\begin{aligned} E(S_2) &= E(S_1) \times (1 + .06) \\ &= .53 \times 1.06 \\ &= .562 \end{aligned}$$

Notice that we could have written this as:

$$\begin{aligned} E(S_2) &= .53 \times 1.06 \\ &= .50 \times (1.06 \times 1.06) \\ &= .50 \times 1.06^2 \end{aligned}$$

In general, relative PPP says that the expected exchange rate at some time in the future, $E(S_t)$, is:

$$E(S_t) \cong S_0 \times [1 + (h_{FC} - h_{US})]^t \quad [20.3]$$

As we will see, this is a very useful relationship.

Because we don't really expect absolute PPP to hold for most goods, we will focus on relative PPP in our following discussion. Henceforth, when we refer to PPP without further qualification, we mean relative PPP.

**EXAMPLE 20.4**

**It's All Relative**

Suppose the Japanese exchange rate is currently 105 yen per dollar. The inflation rate in Japan over the next three years will run, say, 2 percent per year, whereas the U.S. inflation rate will be 6 percent. Based on relative PPP, what will the exchange rate be in three years?

Because the U.S. inflation rate is higher, we expect that a dollar will become less valuable. The exchange rate change will be 2 percent − 6 percent = −4 percent per year. Over three years, the exchange rate will fall to:

$$\begin{aligned} E(S_3) &\cong S_0 \times [1 + (h_{FC} - h_{US})]^3 \\ &\cong 105 \times [1 + (-.04)]^3 \\ &\cong 92.90 \end{aligned}$$

**CURRENCY APPRECIATION AND DEPRECIATION** We frequently hear things like "the dollar strengthened (or weakened) in financial markets today" or "the dollar is expected to appreciate (or depreciate) relative to the pound." When we say that the dollar strengthens or appreciates, we mean that the value of a dollar rises, so it takes more foreign currency to buy a dollar.

What happens to the exchange rates as currencies fluctuate in value depends on how exchange rates are quoted. Because we are quoting them as units of foreign currency per dollar, the exchange rate moves in the same direction as the value of the dollar: It rises as the dollar strengthens, and it falls as the dollar weakens.

Relative PPP tells us that the exchange rate will rise if the U.S. inflation rate is lower than the foreign country's. This happens because the foreign currency depreciates in value and therefore weakens relative to the dollar.

## 20.4 INTEREST RATE PARITY, UNBIASED FORWARD RATES, AND THE INTERNATIONAL FISHER EFFECT

The next issue we need to address is the relationship between spot exchange rates, forward exchange rates, and interest rates. To get started, we need some additional notation:

$F_t$ = Forward exchange rate for settlement at Time $T$

$R_{US}$ = U.S. nominal risk-free interest rate

$R_{FC}$ = Foreign country nominal risk-free interest rate

As before, we will use $S_0$ to stand for the spot exchange rate. You can take the U.S. nominal risk-free rate, $R_{US}$, to be the T-bill rate.

## Covered Interest Arbitrage

Suppose we observe the following information about U.S. and Swiss currencies in the market:

$$S_0 = \text{Fr } 2.00$$
$$F_1 = \text{Fr } 1.90$$
$$R_{US} = 10\%$$
$$R_S = 5\%$$

where $R_S$ is the nominal risk-free rate in Switzerland. The period is one year, so $F_1$ is the 360-day forward rate.

> For exchange rates and even pictures of non-U.S. currencies, see www.travlang.com/money.

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Do you see an arbitrage opportunity here? There is one. Suppose you have $1 to invest, and you want a riskless investment. One option you have is to invest the $1 in a riskless U.S. investment such as a 360-day T-bill. If you do this, then in one period your $1 will be worth:

$$\begin{aligned}\text{\$ value in 1 period} &= \$1 \times (1 + R_{US}) \\ &= \$1.10\end{aligned}$$

Alternatively, you can invest in the Swiss risk-free investment. To do this, you need to convert your $1 to Swiss francs and simultaneously execute a forward trade to convert francs back to dollars in one year. The necessary steps would be as follows:

1. Convert your $1 to $1 × $S_0$ = Fr 2.00.
2. At the same time, enter into a forward agreement to convert Swiss francs back to dollars in one year. Because the forward rate is Fr 1.90, you will get $1 for every Fr 1.90 that you have in one year.
3. Invest your Fr 2.00 in Switzerland at $R_S$. In one year, you will have:

$$\begin{aligned}\text{Fr value in 1 year} &= \text{Fr } 2.00 \times (1 + R_s) \\ &= \text{Fr } 2.00 \times 1.05 \\ &= \text{Fr } 2.10\end{aligned}$$

4. Convert your Fr 2.10 back to dollars at the agreed-upon rate of Fr 1.90 = $1. You end up with:

$$\begin{aligned}\text{\$ value in 1 year} &= \text{Fr } 2.10/1.90 \\ &= \$1.1053\end{aligned}$$

Notice that the value in one year resulting from this strategy can be written as:

$$\begin{aligned}\text{\$ value in 1 year} &= \$1 \times S_0 \times (1 + R_s)/F_1 \\ &= \$1 \times 2 \times 1.05/1.90 \\ &= \$1.1053\end{aligned}$$

The return on this investment is apparently 10.53 percent. This is higher than the 10 percent we get from investing in the United States. Because both investments are risk-free, there is an arbitrage opportunity.

To exploit the difference in interest rates, you need to borrow, say, $5 million at the lower U.S. rate and invest it at the higher Swiss rate. What is the round-trip profit from doing this? To find out, we can work through the steps outlined previously:

1. Convert the $5 million at Fr 2 = $1 to get Fr 10 million.
2. Agree to exchange Swiss francs for dollars in one year at Fr 1.90 to the dollar.
3. Invest the Fr 10 million for one year at $R_S$ = 5 percent. You end up with Fr 10.5 million.

4. Convert the Fr 10.5 million back to dollars to fulfill the forward contract. You receive Fr 10.5 million/1.90 = $5,526,316.
5. Repay the loan with interest. You owe $5 million plus 10 percent interest, for a total of $5.5 million. You have $5,526,316, so your round-trip profit is a risk-free $26,316.

The activity that we have illustrated here goes by the name of *covered interest arbitrage*. The term *covered* refers to the fact that we are covered in the event of a change in the exchange rate because we lock in the forward exchange rate today.

## Interest Rate Parity

If we assume that significant covered interest arbitrage opportunities do not exist, then there must be some relationship between spot exchange rates, forward exchange rates, and

relative interest rates. To see what this relationship is, note that, in general, Strategy 1 from the preceding discussion, investing in a riskless U.S. investment, gives us $1 + R_{US}$ for every dollar we invest. Strategy 2, investing in a foreign risk-free investment, gives us $S_0 \times (1 + R_{FC})/F_1$ for every dollar we invest. Because these have to be equal to prevent arbitrage, it must be the case that: page 630

$$1 + R_{US} = S_0 \times (1 + R_{FC})/F_1$$

Rearranging this a bit gets us the famous **interest rate parity (IRP)** condition:

$$F_1/S_0 = (1 + R_{FC})/(1 + R_{US}) \qquad [20.4]$$

There is a very useful approximation for IRP that illustrates very clearly what is going on and is not difficult to remember.[3] If we define the percentage forward premium or discount as $(F_1 - S_0)/S_0$, then IRP says that this percentage premium or discount is *approximately* equal to the difference in interest rates:

$$(F_1 - S_0)/S_0 \cong R_{FC} - R_{US} \qquad [20.5]$$

Very loosely, what IRP says is that any difference in interest rates between two countries for some period is just offset by the change in the relative value of the currencies, thereby eliminating any arbitrage possibilities. Notice that we could also write

$$F_1 \cong S_0 \times [1 + (R_{FC} - R_{US})] \qquad [20.6]$$

In general, if we have $T$ periods instead of just one, the IRP approximation is written as

$$F_t \cong S_0 \times [1 + (R_{FC} - R_{US})]^t \qquad [20.7]$$

## EXAMPLE 20.5

### Parity Check

Suppose the exchange rate for Japanese yen, $S_0$, is currently ¥120 = $1. If the interest rate in the United States is $R_{US}$ = 10 percent and the interest rate in Japan is $R_J$ = 5 percent, then what must the forward rate be to prevent covered interest arbitrage?

From IRP, we have:

$$F_1 \cong S_0 \times [1 + (R_J - R_{US})]$$
$$\cong ¥120 \times [1 + (.05 - .10)]$$
$$\cong ¥120 \times .95$$
$$\cong ¥114$$

Notice that the yen will sell at a premium relative to the dollar. (Why?)

## Forward Rates and Future Spot Rates

In addition to PPP and IRP, there is one more basic relationship we need to discuss. What is the connection between the forward rate and the expected future spot rate? The **unbiased forward rate (UFR)** condition says that the forward rate, $F_1$, is equal to the *expected* future spot rate, $E(S_1)$:

$$F_1 = E(S_1)$$

With $t$ periods, UFR would be written as:

$$F_t = E(S_t)$$

Loosely, the UFR condition says that, on average, the forward exchange rate is equal to the future spot exchange rate.

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If we ignore risk, then the UFR condition should hold. Suppose the forward rate for the Japanese yen is consistently lower than the future spot rate by, say, 10 yen. This means that anyone who wanted to convert dollars to yen in the future would consistently get more yen by not agreeing to a forward exchange. The forward rate would have to rise to get anyone interested in a forward exchange.

Similarly, if the forward rate were consistently higher than the future spot rate, then anyone who wanted to convert yen to dollars would get more dollars per yen by not agreeing to a forward trade. The forward exchange rate would have to fall to attract such traders.

For these reasons, the forward and actual future spot rates should be equal to each other on average. What the future spot rate will actually be is uncertain, of course. The UFR condition may not hold if traders are willing to pay a premium to avoid this uncertainty. If the condition does hold, then the 180-day forward rate that we see today should be an unbiased predictor of what the exchange rate will actually be in 180 days.

## Putting It All Together

We have developed three relationships, PPP, IRP, and UFR, that describe the interaction between key financial variables such as interest rates, exchange rates, and inflation rates. We now explore the implications of these relationships as a group.

**UNCOVERED INTEREST PARITY** To start, it is useful to collect our international financial market relationships in one place:

$$\text{PPP: } E(S_1) \cong S_0 \times [1 + (h_{FC} - h_{US})]$$
$$\text{IRP: } \quad F_1 \cong S_0 \times [1 + (R_{FC} - R_{US})]$$
$$\text{UFR: } \quad F_1 = F_1 = E(S_1)$$

We begin by combining UFR and IRP. Because we know that $F_1 = E(S_1)$ from the UFR condition, we can substitute $E(S_1)$ for $F_1$ in IRP.[4] The result is:

$$\text{UIP: } E(S_1) = S_0 \times [1 + (R_{FC} - R_{US})] \qquad [20.8]$$

This important relationship is called **uncovered interest parity (UIP)**, and it will play a key role in our international capital budgeting discussion that follows. With $T$ periods, UIP becomes

$$E(S_t) = S_0 \times [1 + (R_{FC} - R_{US})]^t \qquad [20.9]$$

**THE INTERNATIONAL FISHER EFFECT** Next, we compare PPP and UIP. Both of them have $E(S_1)$ on the left-hand side, so their right-hand sides must be equal. We thus have that:

$$S_0 \times [1 + (h_{FC} - h_{US})] = S_0 \times [1 + (R_{FC} - R_{US})]$$
$$h_{FC} - h_{US} = R_{FC} - R_{US}$$

This tells us that the difference in returns between the United States and a foreign country is just equal to the difference in inflation rates. Rearranging this slightly gives us the **international Fisher effect** (IFE):

$$\text{IFE: } R_{US} - h_{US} = R_{FC} - h_{FC} \qquad [20.10]$$

The IFE says that *real* rates are equal across countries.[5] page 632

The conclusion that real returns are equal across countries is really basic economics. If real returns were higher in, say, Brazil than in the United States, money would flow out of U.S. financial markets and into Brazilian markets. Asset prices in Brazil would rise and their returns would fall. At the same time, asset prices in the United States would fall and their returns would rise. This process acts to equalize real returns.

Having said all this, we need to note a couple of things. First of all, we really haven't explicitly dealt with risk in our discussion. We might reach a different conclusion about real returns once we do, particularly if people in different countries have different tastes and attitudes toward risk. Second, there are many barriers to the movement of money and capital around the world. Real returns might be different in two countries for long periods of time if money can't move freely between them.

Despite these problems, we expect that capital markets will become increasingly internationalized. As this occurs, any differences in real rates that do exist will probably diminish. The laws of economics have very little respect for national boundaries.

## 20.5 INTERNATIONAL CAPITAL BUDGETING

Kihlstrom Equipment, a U.S.-based international company, is evaluating an overseas investment. Kihlstrom's exports of drill bits have increased to such a degree that it is considering building a distribution center in France. The project will cost €2 million to launch. The cash flows are expected to be €.9 million a year for the next three years.

The current spot exchange rate for euros is €.5. Recall that this is euros per dollar, so a euro is worth \$1/.5 = \$2. The risk-free rate in the United States is 5 percent, and the risk-free rate in "euroland" is 7 percent. Note that the exchange rate and the two interest rates are observed in financial markets, not estimated.[6] Kihlstrom's required return on dollar investments of this sort is 10 percent.[7]

Should Kihlstrom take this investment? As always, the answer depends on the NPV, but how do we calculate the net present value of this project in U.S. dollars? There are two basic ways to go about doing this:

1. *The Home Currency Approach.* Convert all the euro cash flows into dollars, and then discount at 10 percent to find the NPV in dollars. Notice that for this approach, we have to come up with the future exchange rates to convert the future projected euro cash flows into dollars.
2. *The Foreign Currency Approach.* Determine the required return on euro investments, and then discount the euro cash flows to find the NPV in euros. Then convert this euro NPV to a dollar NPV. This approach requires us to somehow convert the 10 percent dollar required return to the equivalent euro required return.

The difference between these two approaches is primarily a matter of when we convert from euros to dollars. In the first case, we convert before estimating the NPV. In the second case, we convert after estimating NPV.

It might appear that the second approach is superior because it only requires us to come up with one number, the euro discount rate. Furthermore, because the first approach requires us to forecast future exchange rates, it probably seems that there is greater room for error with this approach. As we illustrate next, however, based on our previous results, the two approaches are really the same.

## Method 1: The Home Currency Approach

To convert the projected future cash flows into dollars, we will invoke the uncovered interest parity, or UIP, relation to come up with the projected exchange rates. Based on our earlier discussion, the expected exchange rate at Time $t$, $E(S_t)$, is:

$$E(S_t) = S_0 \times [1 + (R_€ - R_{US})]^t$$

where $R_€$ stands for the nominal risk-free rate in euroland. Because $R_€$ is 7 percent, $R_{US}$ is 5 percent, and the current exchange rate ($S_0$) is €.5:

$$\begin{aligned} E(S_t) &= .5 \times [1 + (.07 - .05)]^t \\ &= .5 \times 1.02^t \end{aligned}$$

The projected exchange rates for the drill bit project are thus:

| YEAR | EXPECTED EXCHANGE RATE |
|---|---|
| 1 | €.5 × $1.02^1$ = €.5100 |
| 2 | €.5 × $1.02^2$ = €.5202 |
| 3 | €.5 × $1.02^3$ = €.5306 |

Using these exchange rates, along with the current exchange rate, we can convert all of the euro cash flows to dollars (note that all of the cash flows in this example are in millions):

| YEAR | (1) CASH FLOW IN € MIL | (2) EXPECTED EXCHANGE RATE | (3) CASH FLOW IN $MIL (1)/(2) |
|---|---|---|---|
| 0 | −€2.0 | €.5000 | −$4.00 |
| 1 | .9 | .5100 | 1.76 |
| 2 | .9 | .5202 | 1.73 |
| 3 | .9 | .5306 | 1.70 |

To finish off, we calculate the NPV in the ordinary way:

$$\begin{aligned} \text{NPVs} &= -\$4 + \$1.76/1.10 + \$1.73/1.10^2 + \$1.70/1.10^3 \\ &= \$.3 \text{ million} \end{aligned}$$

So the project appears to be profitable.

## Method 2: The Foreign Currency Approach

Kihlstrom requires a nominal return of 10 percent on the dollar-denominated cash flows. We need to convert this to a rate suitable for euro-denominated cash flows. Based on the international Fisher effect, we know that the difference in the nominal rates is:

$$\begin{aligned} R_{€} - R_{US} &= h_{€} - h_{US} \\ &= 7\% - 5\% = 2\% \end{aligned}$$

The appropriate discount rate for estimating the euro cash flows from the drill bit project is approximately equal to 10 percent plus an extra 2 percent to compensate for the greater euro inflation rate. page 634

If we calculate the NPV of the euro cash flows at this rate, we get:

$$NPV_€ = -€2 + €.9/1.12 + €.9/1.12^2 + €.9/1.12^3$$
$$= €.16 \text{ million}$$

The NPV of this project is €.16 million. Taking this project makes us €.16 million richer today. What is this in dollars? Because the exchange rate today is €.5, the dollar NPV of the project is:

$$NPV_\$ = NPV_€ S_0 = €.16/.5 = \$.3 \text{ million}$$

This is the same dollar NPV that we previously calculated.[8]

The important thing to recognize from our example is that the two capital budgeting procedures are actually the same and will always give the same answer. In this second approach, the fact that we are implicitly forecasting exchange rates is simply hidden. Even so, the foreign currency approach is computationally a little easier.

## Unremitted Cash Flows

The previous example assumed that all aftertax cash flows from the foreign investment could be remitted to (paid out to) the parent firm. Actually, substantial differences can exist between the cash flows generated by a foreign project and the amount that can actually be remitted, or "repatriated," to the parent firm.

A foreign subsidiary can remit funds to a parent in many forms, including the following:

1. Dividends.
2. Management fees for central services.
3. Royalties on the use of trade names and patents.

However cash flows are repatriated, international firms must pay special attention to remittances, because there may be current and future controls on remittances. Many governments are sensitive to the charge of being exploited by foreign national firms. In such cases, governments are tempted to limit the ability of international firms to remit cash flows. Funds that cannot currently be remitted are sometimes said to be *blocked*.

# 20.6 EXCHANGE RATE RISK

**Exchange rate risk** is the natural consequence of international operations in a world where relative currency values move up and down. Managing exchange rate risk is an important part of international finance. For example, as mentioned in the chapter opener, Toyota estimates that it loses about ¥40 billion ($374 million) in operating profit for every yen that the dollar falls. As we discuss next, there

are three different types of exchange rate risk, or exposure: short-run exposure, long-run exposure, and translation exposure.

## Short-Run Exposure

The day-to-day fluctuations in exchange rates create short-run risks for international firms. Most such firms have contractual agreements to buy and sell goods in the near future at set prices. When different currencies are involved, such transactions have an extra element of risk.

For example, imagine that you are importing imitation pasta from Italy and reselling it in the United States under the Impasta brand name. Your largest customer has ordered 10,000 cases of Impasta. You place the order with your supplier today, but you won't pay until the goods arrive in 60 days. Your selling price is $6 per case. Your cost is 8.4 euros per case, and the exchange rate is currently €1.50, so it takes 1.50 euros to buy $1.

At the current exchange rate, your cost in dollars of filling the order is €8.4/1.5 = $5.60 per case, so your pretax profit on the order is 10,000 × ($6 − 5.60) = $4,000. However, the exchange rate in 60 days will probably be different, so your profit will depend on what the future exchange rate turns out to be.

For example, if the rate goes to €1.6, your cost is €8.4/1.6 = $5.25 per case. Your profit goes to $7,500. If the exchange rate goes to, say, €1.4, then your cost is €8.4/1.4 = $6, and your profit is zero.

The short-run exposure in our example can be reduced or eliminated in several ways. The most obvious way is by entering into a forward exchange agreement to lock in an exchange rate. For example, suppose the 60-day forward rate is €1.58. What will be your profit if you hedge? What profit should you expect if you don't?

If you hedge, you lock in an exchange rate of €1.58. Your cost in dollars will thus be €8.4/1.58 = $5.32 per case, so your profit will be 10,000 × ($6 − 5.32) = $6,800. If you don't hedge, then, assuming that the forward rate is an unbiased predictor (in other words, assuming the UFR condition holds), you should expect that the exchange rate will actually be €1.58 in 60 days. You should expect to make $6,800.

Alternatively, if this strategy is not feasible, you could simply borrow the dollars today, convert them into euros, and invest the euros for 60 days to earn some interest. Based on IRP, this amounts to entering into a forward contract.

## Long-Run Exposure

In the long run, the value of a foreign operation can fluctuate because of unanticipated changes in relative economic conditions. For example, imagine that we own a labor-intensive assembly operation located in another country to take advantage of lower wages. Through time, unexpected changes in economic conditions can raise the foreign wage levels to the point where the cost advantage is eliminated or even becomes negative.

The impact of changes in exchange rate levels can be substantial. For example, in the fourth quarter of 2015, Toyota reported a currency gain of ¥5 billion, its smallest currency gain in 13 quarters. Of course, companies can lose money when the exchange rates swing as well. In the first quarter of 2016, Microsoft reported a loss of $443 million due to exchange rate changes.

Hedging long-run exposure is more difficult than hedging short-term risks. For one thing, organized forward markets don't exist for such long-term needs. Instead, the primary option that firms have is to try to match up foreign currency inflows and outflows. The same thing goes for matching foreign currency-denominated assets and liabilities. For example, a firm that sells in a foreign country might try to concentrate its raw material purchases and labor expense in that country. That way, the dollar values of its revenues and costs will move up and down together. Probably the best examples of this type of hedging are the so-called transplant auto manufacturers such as BMW, Honda, Mercedes, and Toyota, which now build a substantial portion of the cars they sell in and outside the United States

at plants located in the United States, thereby obtaining some degree of immunization against exchange rate movements.

For example, BMW produces 400,000 cars in South Carolina and exports about 280,000 of them. The costs of manufacturing the cars are paid mostly in dollars, and when BMW exports the cars to Europe, it receives euros. When the dollar weakens, these vehicles become more profitable for BMW. At the same time, BMW exports about 200,000 cars to the United States each year. The costs of manufacturing these imported cars are mostly in euros, so they become less profitable when the dollar weakens. Taken together, these gains and losses tend to offset each other and provide BMW with a natural hedge.

Similarly, a firm can reduce its long-run exchange rate risk by borrowing in the foreign country. Fluctuations in the value of the foreign subsidiary's assets will then be at least partially offset by changes in the value of the liabilities. page 636

## Translation Exposure

When a U.S. company calculates its accounting net income and EPS for some period, it must "translate" everything into dollars. This can create some problems for the accountants when there are significant foreign operations. In particular, two issues arise:

1. What is the appropriate exchange rate to use for translating each balance sheet account?
2. How should balance sheet accounting gains and losses from foreign currency translation be handled?

To illustrate the accounting problem, suppose we started a small foreign subsidiary in Lilliputia a year ago. The local currency is the gulliver, abbreviated GL. At the beginning of the year, the exchange rate was GL 2 = $1, and the balance sheet in gullivers looked like this:

| | | | |
|---|---|---|---|
| Assets | GL 1,000 | Liabilities | GL 500 |
| | | Equity | 500 |

At 2 gullivers to the dollar, the beginning balance sheet in dollars was as follows:

| | | | |
|---|---|---|---|
| Assets | $500 | Liabilities | $250 |
| | | Equity | 250 |

Lilliputia is a quiet place, and nothing at all actually happened during the year. As a result, net income was zero (before consideration of exchange rate changes). However, the exchange rate did change to 4 gullivers = $1 purely because the Lilliputian inflation rate is much higher than the U.S. inflation rate.

Because nothing happened, the accounting ending balance sheet in gullivers is the same as the beginning one. However, if we convert it to dollars at the new exchange rate, we get:

| | | | |
|---|---|---|---|
| Assets | $250 | Liabilities | $125 |
| | | Equity | 125 |

Notice that the value of the equity has gone down by $125, even though net income was exactly zero. Despite the fact that absolutely nothing really happened, there is a $125 accounting loss. How to handle this $125 loss has been a controversial accounting question.

One obvious and consistent way to handle this loss is simply to report the loss on the parent's income statement. During periods of volatile exchange rates, this kind of treatment can dramatically impact an international company's reported EPS. This is a purely accounting phenomenon, but even so, such fluctuations are disliked by some financial managers.

The current approach to handling translation gains and losses is based on rules set out in the Financial Accounting Standards Board (FASB) *Statement of Financial Accounting Standards No. 52* (FASB 52), issued in December 1981. For the most part, FASB 52 requires that all assets and

liabilities be translated from the subsidiary's currency into the parent's currency using the exchange rate that currently prevails.

Any translation gains and losses that occur are accumulated in a special account within the shareholders' equity section of the balance sheet. This account might be labeled something like "unrealized foreign exchange gains (losses)." The amounts involved can be substantial, at least from an accounting standpoint. For example, Home Depot's

January 31, 2016, 10-K showed a loss of $898 million. These gains and losses are not reported on the income statement. As a result, the impact of translation gains and losses will not be recognized explicitly in net income until the underlying assets and liabilities are sold or otherwise liquidated. page 637

## Managing Exchange Rate Risk

For a large multinational firm, the management of exchange rate risk is complicated by the fact that there can be many different currencies involved in many different subsidiaries. It is very likely that a change in some exchange rate will benefit some subsidiaries and hurt others. The net effect on the overall firm depends on its net exposure.

For example, suppose a firm has two divisions. Division A buys goods in the United States for dollars and sells them in Britain for pounds. Division B buys goods in Britain for pounds and sells them in the United States for dollars. If these two divisions are of roughly equal size in terms of their inflows and outflows, then the overall firm obviously has little exchange rate risk.

In our example, the firm's net position in pounds (the amount coming in less the amount going out) is small, so the exchange rate risk is small. However, if one division, acting on its own, were to start hedging its exchange rate risk, then the overall firm's exchange rate risk would go up. The moral of the story is that multinational firms have to be conscious of the overall position that the firm has in a foreign currency. For this reason, management of exchange rate risk is probably best handled on a centralized basis.

# 20.7 POLITICAL RISK

One final element of risk in international investing is **political risk**. Political risk refers to changes in value that arise as a consequence of political actions. This is not a problem faced exclusively by international firms. For example, changes in U.S. tax laws and regulations may benefit some U.S. firms and hurt others, so political risk exists nationally as well as internationally.

Some countries do have more political risk than others, however. When firms have operations in these riskier countries, the extra political risk may lead the firms to require higher returns on overseas investments to compensate for the possibility that funds may be blocked, critical operations interrupted, and contracts abrogated. In the most extreme case, the possibility of outright confiscation may be a concern in countries with relatively unstable political environments.

> A great site for evaluating the political risk of a country is www.cia.gov.

Political risk also depends on the nature of the business; some businesses are less likely to be confiscated because they are not particularly valuable in the hands of a different owner. An assembly operation supplying subcomponents that only the parent company uses would not be an attractive "takeover" target, for example. Similarly, a manufacturing operation that requires the use of specialized components from the parent is of little value without the parent company's cooperation.

Natural resource developments, such as copper mining or oil drilling, are just the opposite. Once the operation is in place, much of the value is in the commodity. The political risk for such investments is much higher for this reason. Also, the issue of exploitation is more pronounced with such investments, again increasing the political risk.

Political risk can be hedged in several ways, particularly when confiscation or nationalization is a concern. The use of local financing, perhaps from the government of the foreign country in question, reduces the possible loss because the company can refuse to pay on the debt in the event of unfavorable political activities. Based on our discussion in this section, structuring the operation in such a way that it requires significant parent company involvement to function is another way to reduce political risk.