Basics of Foreign Exchange

Adapted from **CNBC 24/7 Trading Around the Clock, Around the World** by Barbara Rockefeller (Wiley, 2001)

Understanding Different Currency Quotation Conventions

The two different quotation conventions in foreign exchange are vexing. Of all nationalities, Americans have the hardest time with currency quotations, and not because they are provincial or lack the cross-border experience of (say) Europeans. Since WW II, the U.S. dollar has been the main world reserve and transaction currency. In fact, approximately 65% of all foreign trade is U.S. dollar-denominated. For example, oil and most commodities are denominated in U.S. dollars

Depending on where you are in the world, there are two ways to express the value of a U.S. dollar. For example, sometimes the Canadian dollar is expressed as worth "$1.45" (in U.S. dollars) and another time you will see it quoted as "0.6897." These two numbers are actually the same price, quoted in different formats. In the interbank "spot" foreign exchange market, where participants are professionals and the amounts traded are large (i.e., a minimum of $1 million), nearly every currency is quoted as a function of the U.S. dollar. So this explains the first quotation convention above: one U.S. dollar will buy 1.45 Canadian dollars.

Alternatively, you could say each Canadian dollar is worth 68.97 U.S. cents, or $0.6897. Arithmetically, you get from one to the other by dividing into the numeral 1.00, which, divided by 1.45 equals 0.6897 and divided by 0.6897 equals 1.45. This is called the reciprocal. Some experienced currency traders can do the division in their head, but you don't have to. But you do need to know which quotation convention is being used in any particular situation.

The quotation convention challenge is even further complicated by the British pound (and often the Australian dollar). The pound is quoted in the "**American quotation convention**," or dollars per UK pound (such as £1 = $1.65). It is very seldom quoted the other way, in the "**European quotation convention**," whereby one dollar equals 60.61 British pence. Then along came the euro, the currency that replaced the Deutschemark, French franc, Italian lira, and other currencies of the European Monetary Union. The EMU "issued" the first euro (it was actually just a bookkeeping entry at that time), on the first business day of 1999. In other words, the Europeans chose the American convention instead of the European version, specifically so the name "euro" comes first.

Different Quotation Conventions Are Used by Different Markets

Returning to the subject of quotation conventions, the two coexist side-by-side and usage has not been standardized because the *European* quotation convention is used in the professional foreign exchange market and the *American* quotation convention is used in the Chicago and other futures markets. Although there is active and efficient arbitrage

between the two markets (ensuring that prices are very close, although not perfectly equivalent at all times), the participants in each market are very different.

The Professional Market. The professional (or **"spot") market** is dominated by commercial and investment bank "proprietary traders" who are essentially speculating with the banks' credit lines, as well as corporations conducting transactions overseas, governments, hedge funds, and brokers buying and selling stocks and bonds for customers.

This market is the largest and most liquid market in the world, about $5 trillion per day, according to the Bank for International Settlements in Switzerland. This makes it bigger than all the world stock a markets put together. It is open almost twenty-four hours a day. The only downtime is a few hours between the U.S. close and the Australian open, and even that is mitigated by most big banks having overnight FX desks in every money-center city.

In recent years, the spot market has been opened up to the smaller retail trader. We will discuss this below. Keep in mind that professional dealers are trading in sums usually starting at $2-5 million per trade. It is not really true that if you are trading in the retail spot market, you are on a par with the professionals. For one thing, you don't have their credit-worthiness. For another, you are not a market-maker. To be a market-maker means you stand ready to make a bid or an offer on any currency at any hour. As a small retail trader, you are always the broker's customer, never his equal or peer.

Futures Markets. In contrast, futures markets are patronized by smaller businesses whose transactions are not big enough for the professional market (or they do not qualify for bank credit lines) and speculators of all levels of expertise, from the amateur day-trader working from a downstairs den to sophisticated proprietary traders at banks and brokerages. In the U.S., currency futures are traded chiefly at the International Monetary Market (IMM) division of the Chicago Mercantile Exchange as well as other exchanges.

The futures contract quote differs from the spot quote because it embodies the interest rate differential between the two countries. In a futures contract, you are agreeing today to a price at which you will exchange pounds for dollars on some date in the future; in the meanwhile, you get to earn interest on your dollars, and the counterparty gets to earn interest on his pounds.

For example, let's say you can earn 1% flat on your dollars in two months (6% p.a. / 12 months x 2 = 1%). You are a buyer of pounds today for delivery in two months. The seller of the pounds gets to keep the interest he will make over those two months. (The outright two-month interest rate in Britain is 0.75%.) At the current spot price of $1.60 per pound, one UK pound futures contract of £62,500 is equal to $100,000. Here's the math:

You earn: $100,000 x 0.01 = $1,000; $100,000 + $1,000 = $101,000.
The counterparty earns: £62,500 x 0.075 = £468.75; £62,500 + £468.75 = £62,968.75.

Now divide your $101,000 by his £62,968.75, and you get $1.6040.

The pounds you will be getting are slightly more expensive to make up for the fact that you earned a little more interest while you were still holding the counterparty's dollars ahead of delivery to him. If the pound were not more expensive for future delivery, everybody and his brother would buy dollars to earn the extra 0.25% interest and still be able to sell their dollars without penalty (and U.S. money supply would balloon).

All Futures Contract are Forward Contracts

All forward or future exchange rates are set this way. A **forward rate** is the exact same thing as a **future rate** and they will be identical values for the same delivery date. The only difference is that in the professional foreign exchange market, you can name your delivery date, whereas in the futures market, you are limited to the delivery dates specified by the exchange. In the professional market, the process by which the interest rate differential and the forward rate are continuously kept in this balance is named **"covered interest arbitrage."** In other words, a forward or future rate is *not* a forecast of what the price will be in the future, but solely a function of the two interest rates.

To say that a forward rate is an unbiased predictor of the future rate is to miss this critical point. Many Ph.D. dissertations have tortured the arithmetic to make the forward rate a predictor of the future rate, usually without much luck. Something else is happening, though, that often makes the forward rate a predictor of the future rate, because the reason for the high interest rate is high inflation. The country with a higher interest rate usually has either higher inflation or an expectation of higher inflation. Higher inflation countries usually experience a drop in their exchange rates because of the mechanism described below. A country's higher inflation rate causes its currency to sell at a forward discount (i.e., less valuable in the future), and its currency falls because its purchasing power is being eroded by inflation.

How Exchange Rates are Determined

In a world where trade in physical goods dominates the determination of exchange rates, that country's goods are (or will become) more expensive via price inflation than every other country's goods. Therefore, it will not be able to export, and it will have to use foreign currency *reserves* to pay for imports. When its reserves run low, it will be forced to depreciate its currency in order to restore purchasing power parity.

The purchasing power parity/balance of foreign trade model dominated exchange rate analysis at a time when exchange rates were fixed and in the early days of floating rates (which started in 1974). At that time, government-imposed capital controls prevented a free flow of capital into and out of countries. Gradually, starting in the early 1970's and continuing even today, capital controls were relaxed. For example, if you were a Briton who wanted to invest in the U.S. stock market, you had to pay a premium of 15-25% to buy the dollars to do it. Upon being elected prime minister in 1979, Margaret Thatcher made good her campaign promise of abolishing that capital control.

Nowadays, we have mostly free capital flows among the major countries. This means that a country can run a huge trade surplus and not face a decline in its currency as long as capital is flowing in. This is, of course, the situation in the U.S. today. Some analysts persist in saying the dollar must fall because we buy so much more from overseas than we sell. Others point out that foreigners have an undiminished appetite for American government and corporate bonds, Wall Street stocks, and direct purchases of U.S. companies and real estate. Very little of the capital inflow is **"hot money"** (able to exit on short notice)—less than 15% of the U.S. stock market is owned by foreigners. In 1999, the inflow was more than double the trade deficit. By 2007/2008, the inflow was bigger than the trade deficit but in some months, by only a small amount (like $5-10 billion).

Forecasting Exchange Rates

Combining analysis of trade flows and capital flows, as well as other domestic conditions such as inflation, leads to the forecasting challenge. Forecasting corporate earnings pales in comparison to the complexity of forecasting exchange rates. Every month, we hear that the U.S. trade deficit has risen again to a historic high level, and commentators say the dollar should fall. But month after month, it fails to fall. Then one month it does fall, but only a little and only for a short time.

The capital flow model of exchange rate determination says that the country with the highest interest rate will get the biggest inflows (all other things being equal), and they will more than offset the trade deficit. This is true, up to the point where foreigners own as many U.S. assets as they want in their portfolios. As former Fed Chairman Alan Greenspan and other Federal Reserve Bank officials have reminded us, at some point you have to wonder when they will feel they have as much as they could possibly want.

As noted above, the country with the higher interest rate sells at a **forward discount**, that is, it is cheaper for delivery on a date in the future. The country with the lower interest rate sells at a **forward premium**, that is, it is more expensive for delivery in the future. It's important not to attach value judgments to the words "discount" and premium." The dollar currently sells for a forward discount because it has a higher interest rate, *not* because it is expected to fall and actually be worth less in the future. If that were true, you'd have a hard time figuring out how much less. This arises from the different quotation conventions described at the beginning of this appendix.

In the professional interbank market, a two-month forward rate for the Canadian dollar may be a 0.46% premium to the spot rate, while in futures the same two-month rate may be 0.62% different from the **spot price**--solely because when you calculate a percentage difference, it does matter arithmetically whether you are using numbers with values less than one or more than one. Academicians consider this a puzzle of finance. It's not—it's simple arithmetic.

A SAMPLE HEDGING EXERCISE

In the following example, the Swiss franc is quoted using the European quotation convention. Each dollar is worth 1.6703 francs at the start, or $0.5987. The forward price for delivery in two months is 1.6663, a lower number but a higher value--$0.6001. The dollar has the higher interest rate and sells at a discount, while the franc has a lower interest rate and sells at a premium. Suppose a Swiss millionaire decides he should investigate the U.S. money markets to maximize the return on his investments. He has Swiss francs (SF), and he decides to invest SF 1,000,000 in the domestic Swiss money market for one month at 2.93%:

SF 1,000,000 x 2.93% = SF 29,300/365 x 30 (days) = SF 2,408.22

He could choose, instead, to invest in the U.S. market. He can sell his SF 1 million in the spot market at 1.6703 and invest the principal at 5.88%, today's one-month Eurodollar rate. The math would look like this:

SF 1,000,000/1.6703 = $598,694.85 x 5.88% = $35,203.26/365 x 30 = $2,893.42

Our Swiss millionaire now has a foreign currency exposure. What if the dollar depreciates against the Swiss franc? After all, the only reason to make an investment in a foreign currency is to get a real return in the *home* currency. The millionaire needs to know the amount that the dollar can depreciate and still allow him to break even with the Swiss franc investment. In simple terms, the answer is:

5.88% U.S. investment rate p.a.
2.93% Swiss investment rate p.a.
2.95% Break-even U.S. dollar depreciation / 12 months = 0.2450%

He will be indifferent between the two investments if he can be sure the dollar will depreciate exactly 0.2450% over the one month of his U.S. investment. Applying this percentage change to the spot price, we get the following:

1.6662 (0.002450 x 1.6703 = .0041; 1.6703 - 0.0041 = 1.6662).

Another way to calculate this is on a cash basis:

Principal + interest in SF = SF 1,002,408.22
Principal + interest in $ = $601,588.27

The breakeven exchange rate is therefore P + i (SF)/P + i ($) = 1.6663.

The one-point difference is due to rounding. Let's say our Swiss millionaire doesn't want to take a chance on the future value of the dollar. To avoid the dollar exposure, he can sell the U.S. dollars one month forward instead of holding the dollar asset unhedged. This would be a **swap**--the simultaneous purchase of dollars for one date (now) and the sale of the same currency for another date (30 days). If he does this, he has engaged in **covered**

interest arbitrage. He has no exchange rate exposure and he has "covered," or hedged, his investment.

The cost of a one-month forward is quoted by the forward dealer at 44 points. We subtract the points from the spot rate to derive the outright forward rate:
1.6703 - .0044 = 1.6659.

The hypothetical break-even rate calculated above is 1.6663, and the actual one-month forward rate available in the market is 1.6659. In other words, the actual rate is *worse* than the indifference point. The Swiss millionaire would get fewer Swiss francs per dollar using the forward market than he needs for a break-even status with the Swiss investment. That the two rates are nearly the same is, however, testimony to the efficiency of the market. Hedging via the swap market is not the only option; he can still do the deal unhedged.

Look at Table B.1, which shows forecasted possible Swiss franc rates. (The formula used is at the top of the relevant columns.)

P + i Earned ($) *times*	**Possible SF Rates** *Equals*	**New SF Amount** *minus*	**SF Principal** *equals*	**Imputed Interest (SF)**	**Imputed Interest %**
$601,588	1.8000	1,082,850	1 MM	82,850	8.29%
$601,588	1.7500	1,052,779	1 MM	52,799	5.28%
$601,588	1.7000	1,022,699	1 MM	22,699	2.27%
$601,588	1.6703	1,004,832	1 MM	4,832	.48%
$601,588	1.6693	1,004,230	1 MM	4,230	.42%
$601,588	1.6663	1,002,426	1 MM	2,426	.24%
$601,588	1.6649	1,001,583	1 MM	1,583	.16%
$601,588	1.6000	962,540	1 MM	(37,460)	(3.75%)
$601,588	1.5500	932.461	1 MM	(67,539)	(6.75%)
$601,588	1.5000	902,382	1 MM	(97,618)	(9.76%)
$601,588	1.4500	872,302	1 MM	(127,698)	(12.77%)

If the dollar were to depreciate to 1.4500 against the Swiss franc, the unhedged position would result in a cash loss of SF 127,698, which can be likened to a negative interest rate of 12.77%. On the other hand, if the dollar were to rise to 1.8000, he would get interest earnings of SF 82,850, which is the equivalent of an effective interest rate of 8.29%.

The forward and futures markets are always available. If the underlying exchange rate moves in the Swiss millionaire's favor, he can call his bank or broker at virtually any time for execution of the second leg of the swap. Of equal interest to him is that if the interest rate changes in either country, the cost of the forward-to-close will also change--in his favor if it narrows and against him if it widens.

For new traders, there is an important lesson in this story. The case of how professionals equalize cash flows between countries illustrates that the forward rate is not a forecast, a guess or a hope. It is the result of hardheaded exploitation of small arbitrage opportunities. In other words, there is no point in criticizing the forward rate for being "wrong." It can't be wrong: It is set by the interest rate differentials, and nothing else.

HOW TO FORECAST EXCHANGE RATES

Unlike gold, currencies do not have intrinsic value. There's no book value in currencies. Logically, each currency has a country (or a group of countries, in the case of the euro), and each country has a government that is more or less solvent. Just as we assume a company is a "going concern" (i.e., it will stay in business), we assume countries are going concerns, too. The ongoing finances of a country depend on its ability to tax the public. The ability to raise extra money by privatization of government-owned businesses is a one-time thing, but often useful. (If we evaluated countries like companies, the United Kingdom would have to be the best among the major world countries when judged by the going concern criterion. Not only does it have a budget surplus, it also has a fully funded social security program. It is the only major country of which this can be said as of this writing.) And yet, fiscal excellence is only one contributing factor of all those by which currencies are judged.

As a rule, the country with the highest interest rate will lure the most money from other countries, but it doesn't do this without regard for other factors. That country also has to have:

- A stable and honest government,
- The confidence of the financial sector that the central bank is pro-active against inflation,
- Non-punitive taxation,
- Other conditions conducive to foreign investment--including such mundane things as a telephone system that always works and competent bankers--as well as loftier attributes of civilized society such as the rule of law and commercial codes of conduct that are actually enforced.

This last point is not trivial. For example, a bank in Nigeria may offer 150% for one-month deposits, but how confident are you that you will get back your dollars at the end of one month with the interest payment? Nigeria has been the source of several international frauds and scams; the Nigerian Consul General often has to run ads in newspapers (such as the New York Times) warning people that promises of extraordinary gains are seldom true, and they should not trust specific offers coming from Nigeria.

Whenever you make an investment in a foreign country or if you are trading FX as an asset class, you will want to evaluate beforehand whether the exchange rate is fair, and by how much it is likely to change over your expected holding period. We have already learned that the forward rate is not an unbiased predictor of the future rate. Just because a country has a higher interest rates does not *ensure* that its currency will remain high via capital flows. It may actually develop real inflation despite the efforts of the central bank (recall the one-time oil shocks of 1973 and 1978), or foreign investors may simply have as much of that currency as they deem appropriate for their portfolios.

For example, the Fed raised U.S. rates by 50 basis points on May 17, 2000; two days later the dollar fell against the Japanese yen from 109.50 to 106.90. At the time, the Japanese short-term interest rate equivalent of Fed funds was *zero*. This makes no sense at all under the capital flow theory. The reason? A Japanese research institute had just forecast that first quarter GDP growth would be 13.1%, extremely high under any circumstances and especially high in the context of Japan's 10-year recession. If the forecast is correct, the Bank of Japan will be able to abandon the zero interest rate policy sometime in the next six to nine months. The interest rate differential will still be in favor of the U.S. dollar by a huge amount, but by less than it was before. Ergo, traders rush to "buy on the rumor" well in advance of any actual "fact."

You have to face the unhappy fact that currencies can be undervalued or overvalued for long periods of time, and establishing fair value is an endless and often fruitless quest.

Estimating the Value of Foreign Currency: The "Big Mac Price Test"

Let's say you are able to travel internationally and you decide to make your own estimation of the fair value of a currency by traveling to the country and comparing the price of things to the price of things in your home country. For example, you would deem a foreign currency undervalued if a can of Coke that costs $1.00 at home costs 50¢, and overvalued if it costs $2.00. This is a dangerous approach. There are many factors that render the comparison invalid—transportation expense, for one, not to mention import tariffs, lack of local demand for the item, and so on. Cornflakes cost $30 a box in Nairobi. That doesn't mean the Kenyan shilling is overvalued.

The *Economist* magazine publishes a purchasing power comparison based on the price of a McDonalds' Big Mac in 39 countries around the world. This started out nearly 20 years ago as a tongue-in-cheek exercise and has become wildly popular—and often correct. For example, if a Big Mac cost $2.50 in the U.S. and $5.00 in some other country, that country's currency is up to 100% overvalued. The most recent "Big MacCurrencies" index (April 29, 2000) shows that the Japanese yen, for example, "should" be at 117 per

dollar, while it is actually at 106—11% overvalued. The following chart is an excerpt from the Big MacCurrency Index.

Big MacCurrency Index

Country	Dollar Price	Implied Purchasing Power Parity	Actual Exchange Rate (04/25/00)	Undervaluation (-) or Overvaluation Against the U.S. Dollar
Australia	1.54	1.03	1.68	-38%
Britain	3.00	1.32	1.58	+20%
Canada	1.94	1.14	1.47	-23%
Germany	2.37	1.99	2.11	-6%
Japan	2.78	117	106	+11%
Switzerland	3.48	2.35	1.70	+39%
Argentina	2.50	1.00	1.00	0
Indonesia	1.83	5,777	7,945	-27%
South Africa	1.34	3.59	6.72	-47%

Source: *The Economist,* April 29, 2000, p. 75.

Currencies can be overvalued and undervalued on a purchasing power basis for long periods of time, even when considering a larger basket of goods than a McDonalds' meal. For example, Switzerland has appeal to many foreigners because of bank secrecy and political neutrality. It is a "safe haven" in times of world troubles, whatever its interest rate. At one time in the 1970s, you had to pay Swiss banks to take your money—a negative interest rate, so to speak. Thus, the Swiss franc is almost always overvalued against the U.S. dollar, year after year.

In contrast to Switzerland, Australia is a different kettle of fish. The Australian dollar is considered a "commodity currency," like the Canadian dollar. As commodity prices rose in 2006 and 2007, the A$ followed.