

Chapter 10: Foreign Exchange Rates for Global Investment

Today's Questions

- Exchange rate basics:

- How are currency exchange rates quoted?
- How do bid-ask quotes & spreads work?
- What is the relationship between forward/futures & spot exchange rates?

Currency Exchange Rate Basics

- Currency Abbreviations

- Abbreviations could be

- Commonly used symbols or
- "official" three-letter codes.

Example of symbols

\$ (U.S. dollar), ¥ (Japanese yen), € (euro), £ (British pound), A\$ (Australian dollar) & Sfr (Swiss franc)

Example of three-letter codes

USA, JPY, EUR, GBP, AUD, & CHF

- Currency Exchange Rate Quotations

- A currency exchange rate is the rate used to exchange two currencies.
- An exchange rate states the price of one currency in term of units of another currency:

$$\$/\epsilon \quad \epsilon:\$, \quad ¥:\$ \quad \epsilon:\$ = 1.25$$

- Quote Convention

- All quotes will be presented as $a:b = S$

where: a is the quoted currency

b is the currency in which the price is expressed

S is the price of the quoted currency a in units of currency b

Example: \$:¥ = 130

- means the U.S. dollar is quoted at 130 Japanese yen (¥) per dollar.
- Or the U.S. dollar is priced at 130 yen.

Direct Exchange Quotes

- A direct exchange rate is the domestic price of foreign currency.

Example, an American investor seeing a direct quote $€:\$ = 1.34$
- knows she will pay \$1.34 for one euro

- To a European investor, the direct quote is $\$:\text{€} = 0.74627$
- which says that 1 dollar (foreign currency) is worth 0.74627 euro.
- An appreciation of the foreign currency causes an increase in the direct quote.

Indirect Foreign Exchange Quotations

- An indirect exchange rate is the amount of foreign currency that one unit of domestic currency will purchase.
 - For an American investor, the indirect quote $\$:\text{€} = 0.74627$
says that 1 dollar will purchase 0.74627 euro.
- Direct quotes & indirect quotes are reciprocals of each other.
- An appreciation of the foreign currency causes a decrease in the indirect quote.

Cross Rate Calculation.

- A cross rate

- is the exchange rate between two countries inferred from each country's exchange rate with a third country.

Example: bank A gives the following quotations:

$$\text{€} : \$ = 1.3364$$

$$\$: ¥ = 123.52$$

Calculate the euro in yen ($\text{€} : ¥$) rate.

$$(\text{€} : \$) \times (\$: ¥) = 1.3364 \times 123.52 = 165.07$$

The resulting quotation is:

$$\text{€} : ¥ = 165.07$$

one ~~one~~ euro is worth 165.07 yen.

Foreign Exchange Market

- The international currency market has 2 main components:

1. A worldwide Forex market

- between major banks & specialized currency dealers.

- This is a wholesale interbank market for large transactions.

- It is an OTC market, by telephone & electronic trading platforms. It is the largest & most liquid financial market on the world.

2. A retail Market

- where investors & corporations deal with local banks.

Forex Market Conventions - 1

- There is no need to quote both a direct & indirect rates, e.g. both $\$:\text{€}$ & $\text{€}:\$$.
 - History mostly dictates the exchange rate direction that is selected:
 - There is a decreasing order of seniority with the British pound as the senior currency:
 - The Forex convention is to trade British pounds in units of other currencies,
 - so the quote showing on **Forex trading screens** is the foreign exchange value of one GBP, that is, $\text{GBP}:\text{EUR}$, $\text{GBP}:\text{USD}$, or $\text{GBP}:\text{JPY}$

Forex Market Conventions - 2

- Not all exchange rates are traded
 - In a world with a large number of currencies, there are a very large number of cross exchange rate.
 - For example, with 20 currencies, there are 380 bilateral exchange rates.
 - The exchange rates between two minor currencies are not traded on the Forex market.
 - Only the dollar exchange rate with each minor currency is quoted.
 - Hence to achieve a transaction between two minor currencies, one needs to perform 2 transactions involving the dollar.

Forex Market Conventions - 3

- In the Forex market, quotations on trading screens are generally given with 5 significant digits & 3-letter codes.
 - For example: the $\text{USD}:\text{JPY}$ quote could appear as 120.10 & the $\text{EUR}:\text{USD}$ as 1.2515
- Market makers quote both a bid & an ask price, & there is no additional fee or commission.

Bid-Ask Quotes

- Bid price: the exchange rate at which the dealer is willing to buy the quoted currency in exchange for the second currency.
- Ask (Offer) price: the exchange rate at which the dealer is willing to sell the quoted currency in exchange for the 2nd currency:
- spread: the difference between the bid & ask price

$$\text{Midpoint price} = \frac{(\text{ask} + \text{bid})}{2}$$

Example: Consider the following currency quote in the U.S.

$$\$:\text{€} = 0.9838 - 0.9841$$

→ The bid price is \\$:€ 0.9838

→ The ask price is \\$:€ 0.9841

$$\text{The midpoint price} = \frac{0.9838 + 0.9841}{2} = 0.98395$$

Additional Terminology

- A pip stands for "price interest point" & represents
 - the smallest price fluctuation in the currency price.
 - It is equivalent to the "tick" on stock markets.

Example: €:\\$ = 1.3015 - 1.3019.

- The spread equals 4 pips.

Bid-Ask Spread

- Difference between bid and ask price.
- Can also be calculated as a percentage:

$$\text{Bid-ask spread} = 100 \frac{(\text{ask} - \text{bid})}{\text{ask}}$$

- Size of bid-ask spread increases when exchange rate uncertainty(volatility) & lack of liquidity
 - because of the bank/dealer risk aversion
- Spreads are larger for currencies that have
 - a low trading volume (thinly traded currencies).

Two Principles for Bid-Ask Rates

- The a:b ask exchange rate is the reciprocal of the b:a bid exchange rate.
- The a:b bid exchange rate is the reciprocal of the b:a ask exchange rate.

Example: The \$:¥ quote of \$:¥ = 150.51 - 152.52 is equivalent to a ¥:\$ quote of:

$$\text{¥:\$} = \left(\frac{1}{152.52} \right) - \left(\frac{1}{150.51} \right) = 0.00655 - 0.00664$$

Arbitrage

- involves the simultaneous purchase of an undervalued asset
- or portfolio & sale of an overvalued but equivalent asset or portfolio,
- in order to obtain a risk free profit on the price differential.
- keeps exchange rates in line with each other & with risk free interest rates.

For example, the $\$:\text{€}$ rate must be the same, at a given instant, in Frankfurt, Paris & New York.

Arbitrage Conditions with Exchange Rates

- An arbitrage could be created
 - if it were profitable to buy from one bank & sell to another bank
- When describing arbitrage,
 - we are usually discussing a riskless transaction
 - that does not require any invested capital.

Arbitrage Example

- Consider the following 3 banks each providing a $\$:\text{¥}$ quote:

Bank A	Bank B	Bank C
122.25 - 35	122.40 - 45	122.25 - 45

Does an arbitrage opportunity exist?

One could buy dollars from Bank A from 122.35 yen per dollar and simultaneously sell them ~~to~~ to Bank B for 122.40 yen per dollar. A small gain, but it is riskless and does not require any invested capital.

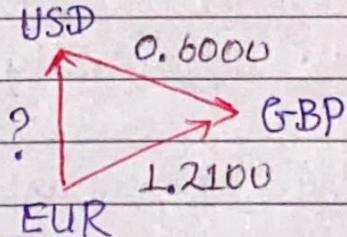
Two Types of Arbitrage Opportunities to consider

- With respect to the exchange rate between two countries,
 - the bid-ask spread in one country should be aligned with the bid-ask spread in the other.
 - if not, a bilateral arbitrage opportunity exists.
- A triangular arbitrage opportunity occurs
 - if the quoted cross-rate between two currencies is higher or lower than the cross-rate implied by the exchange rates of the two currencies against a 3rd currency.

Triangular Arbitrage

- Triangular arbitrage involves 3 steps:

- Pick the cross-rate currency
- Determine whether the cross-rate bid-ask quotes
 - are in line with the direct quotes
 - by determining whether it is cheaper to buy foreign currency directly or indirectly.
- If the actual cross-rate quote
 - is not in line with the quoted cross-rate quotes
 - an arbitrage opportunity exists.



Forward Rates

- Spot rates
 - are quoted from immediate currency transactions
 - (although in practice delivery takes place 48 hours later).
- Forward exchange rates
 - are contracted today but with delivery & settlement in the future

Forward Premiums/Discounts

- Forward exchange rates
 - are often quoted as a premium, or discount, to the spot exchange rate.
- When a trader announces that a currency quotes at a premium,
 - the premium should be added to the spot exchange rate
 - to obtain the value of the forward exchange rate.
- If a currency quotes at a discount,
 - the discount should be subtracted from the spot exchange rate
 - to obtain value of the forward exchange rate.
- Given an exchange rate of a:b, the annualized forward premium on the quoted currency a equals:

$$\left(\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \right) \left(\frac{12}{\text{No. months forward}} \right) 100\%$$

Example: If the 3 month forward exchange rate is $\text{€:\$} = 1.23778$ and the spot rate is $\text{€:\$} = 1.2500$, calculate the forward premium/discount.

$$\left(\frac{1.23778 - 1.2500}{1.2500} \right) \left(\frac{12}{3} \right) 100\% = -3.91\%$$