The Foreign Exchange Market

1 The Structure of the Market

The foreign exchange market is an example of a speculative auction market that trades
the money of various countries continuously around the world. Trading of currencies
takes place by telex, email, fax, etc. Majority of trading occurs among banks. Major
banks trade with each other by selling and buying bank deposits or bank transfers of
deposits denominated in foreign currency. The largest trading centers are in London,
New York, and Tokyo, and these centers account for approximately 70% of the total
exchange.

The New York market opens about 5 hours after the opening of the London market,
Tokyo market opens about 2 hours after the close of the New York market. For the
time zones look at figure 13.2 in your textbook.

Traders in the market in any participating bank are located in a trading room,
where they have access to a telex, telephones and monitors that display a wide set of
information, including economic news as it is released. Most of the trades are conducted
over the phone and subsequently confirmed in writing. In case of errors/mistakes,
traders customarily split the difference.

Despite the growth of international trade, exchange of currencies for transactions of
goods and services has become a distinctly secondary activity in the foreign exchange
market.

Unlike many other financial markets, e.g. the stock market, the actual transactions
prices are generally unobserved. Instead, quotation prices in terms of bid ask rates are
observed.
2 Spot Rate

The spot rate is the price of a currency that is transacted contemporaneously, that is traded in current time period. The market where currencies are traded in current time period is called spot market. Actually, deposits traded in the foreign exchange market generally take two working days to clear. The spot market constitutes about 70% of the exchange rate market transactions. The spot rate data are generally recorded at a particular point of time each day. The Wall Street Journal usually reports spot price information at 3:00pm or 4:00pm the previous working day from the Bankers Trust Company, Reuters, or other sources. The quotations are based on large trades of $1million and more in a basically wholesale market for money among major banks. Indeed, now data is also recorded at very high frequencies, say each one minutes intervals even. This type of data has become available to researcher in recent years.

There are two types of quotations; American terms and European terms.

American Terms refers to the quotation where spot rate is quoted in terms of the number of US dollars per unit of foreign currency, e.g. Franc-$(or $/Franc). The U.S. dollar is the numeraire currency. The Wall Street Journal refers to this method as "Currency per U.S. $".

European Terms refers to the quotation where spot rate is quoted in terms of foreign currency units per U.S. dollar, e.g. $-L(or L/$). In this method of quotation, foreign currency(L) is the numeraire currency. The Wall Street Journal refers to this method as 'U.S. dollar equivalents'.

Reciprocal Rates The choice of numeraire currency is a matter of convenience and alternative method of quotation is simply the reciprocal of the rate. For example, in American terms if Dutch Guilder-US dollar rate, S=9.517 on January 11, 2000, then the reciprocal rate, US Dollar-Dutch Guilder, 1$/g=0.4689.

Note that all of the exchange rate quotes reported in the Wall Street Journal are market traded rates and hence are nominal, in the sense that they are in current prices and are not deflated for price differential across countries. The quoted rates are also
bilateral, as they involve only two currencies. In this regard, exchange rates represent the current price of one currency in terms of another.

**Spreads** Since it is rare to observe a transaction price for an exchange rate, the foreign exchange rate data are given in terms of either ask rates, bid rates, and/or midrange=(ask+bid)/2. Ask or offer rate is the price at which banks are willing to sell currency, and bid rate is the price at which banks are willing to buy currency. The spread is the difference between ask rate and bid rate. Banks bid to buy currency at lower rates than they sell, and the difference between selling and buying rates is called spread. The spread measures the extent of the difference between the ask and bid rates. The spread for any particular currency will vary according to the individual currency trader, the currency being traded, and the trading bank’s overall view of conditions in the foreign exchange rate market. As the volatility (riskiness of a particular currency) increases-exchange rates change at larger magnitudes- the spread will increase as well. For currencies that are thinly traded-currencies that do not generate a large volume of trading- spread tends to increase.

Note also that bid rates are always less than ask rates. Big banks, such as Citibank, Bank of America, Dutch Bank, are known as 'market makers' as they are willing to offer buying (bid) rates and selling (ask) rates on request.

### 3 Arbitrage

Currencies are homogenous goods- a dollar is a dollar no matter where it is traded. Hence, it is very easy to compare prices in different markets. If the value of say US dollar is different in Tokyo and in Sidney then an investor can make riskless profit by buying US dollar in a market where it is cheap and selling it in the market where the US dollar is relatively expensive. In other words, if exchange rates among markets are different from one another for the same currency, then there will be profit opportunities for simultaneously buying a currency in one market while selling in another. This activity,
is known as *arbitrage*, will raise the exchange rate where it is too low and lower it where it is too high. Why? Since information flows in international markets fast and at lower costs, when it is known that a particular currency sells at lower rates then investors will tend to buy the currency from that market. As demand for the currency increases in that market this will increase the exchange rate. Similarly, if the currency is high in value in another market, then investor will tend to sell their holdings of the currency in that market causing an increase in the supply of the currency. This will lower the exchange rate in this market for the currency. Arbitrage occurs until the exchange rates in different markets are so close that it is not worth the costs incurred from any buying and selling. When this situation occurs, we say that the rates are transaction cost close, because any remaining deviation in rates will not cover the costs of additional arbitrage transactions, so the arbitrage activity ends and brings the exchange rates between different locations close to each other.

**Example:** Suppose that in New York, the Japanese Yen is selling for $0.22 while in London the Yen is quoted at $0.25. A profit-seeking arbitrager would buy Yen in New York (where it is cheaper) and simultaneously sell in London (where Yen is expensive) and make 3 cents per Yen sold.

*Cross Rate* is the third exchange rate implied by any two exchange rates involving three currencies.

**Example:** Suppose that in London $/E = $ 1.5, while in Tokyo, $/L = $ 2. The implied cross rate between pounds and euro is the E/L rate. If $/E = 1.5 and $/L = $2 and E/L = ($/L)/($/E) = 2/1.5 = 4/3.

The arbitrage opportunity arise if any of the three exchange rates considered in above example differs drastically from one other.

**Example: Three-way arbitrage:** Suppose in London $/L =$1.90, in Zurich, L/SF=0.2, while in New York $/SF=0.4. A risk taking investor could start with dollars and buy say L1 million in London for $1,900,000. The pounds could be used to buy francs at L/SF=0.2 in Zurich, so that L1,000,000=SF5,000,000. The SF5 million would
then be used in New York to buy dollars at $/SF=$0.40, so that SF5,000,000=$2,000,000. Thus the initial $1.9 million could be turned into $2 million with the triangular arbitrage. Note that we are assuming here costs of transaction is zero. Otherwise we need to deduct the costs. The triangular arbitrage condition is a no-profit condition that relates spot rates and implied cross rates. For instance, the triangular arbitrage condition between dollar rates and pound and euro will be given by;\(\text{($/pound)\times (pound/Euro) = $/Euro.}\) This condition is viewed as an equilibrium condition in the spot market.

4 Forward Rates

Not all the transactions in the foreign exchange (FX) market are on the spot. Important portion of the transactions involve buying and selling future contracts. The forward exchange market is the market where currencies are bought and sold for delivery in a future period. The forward price of a currency is called forward exchange rate. We will denote forward rates by \(F_t\) and \(t\) stands for the time period. For instance, \(F_{t,1}\) is the forward rate for a contract that expires (delivery of the FX is due) on say 1 month from date \(t\). A little bit of terminology:

**short position** When you sell a position, (you agree to sell an asset, say FX for a delivery price), you hope that the underlying asset will go down in price. In this case we say that you have a short position.

**long position** When you buy into a position, (you agree to buy an asset, say FX at a price), you hope that the underlying asset will go up in price. We say that you have a long position.

A pure bet in the forward market involves guessing whether the future spot price, \(S_{t+1}\) will be greater or less than \(F_{t,1}\).

If you are short a forward contract and \(S_{t+1} < F_{t,1}\), (say future spot rate-one month ahead spot rate- is less than 1 month forward rate) you win money. You buy FX at
$S_{t+1}$ and sell at $F_t$ to the counterparty in the forward contract.

If you are long a forward contract and $S_{t+1} > F_t$ then you win money. You get to buy the FX at price $F_t$ and turn around and sell it in the spot market at $S_{t+1}$.

**Example:** Suppose you agree to sell pounds in one month from now to a counterparty at say $F_{t,1} = $1.90 per pound. That is you take a short position in pounds. If the spot future spot rate is $S_{t+1} = $1.85 per pound than at the end of 1 month you buy pounds from 1.85 in the spot market and sell counterparty at 1.90 realizing a net profit of 0.05 cents per pound sold. If on the other hand, future spot rate turns out to be greater than 1.90 you will obviously lose from the contract.

If the forward exchange price of a FX is greater than the current spot, i.e. $F_{t,1} > S_t$ that currency is said to be selling at a *forward premium*. If the forward rate is less than the spot rate, then the currency is said to be selling at a *forward discount*.

Forward contracts are offered at maturities of 30, 60, 90, and 360 days.

## 5 Swaps

A FX swap is a trade that combines both a spot and a forward transaction into one deal. Some swaps combine two forward transactions and are called *forward-forward swaps*. FX swap is an agreement to trade currencies at one date and reverse the trade at a later date.

**Example:** Suppose Bank of America wants pound now. It could borrow the pounds, arranging to repay them say in three months. Then, it could buy pounds in the forward market to ensure a certain price to be paid when the pounds are needed in three months. Here a swap serves as a borrowing and lending operation combined in one deal. The terms of the swap arrangement is closely related to the conditions in forward markets as the swap rates will depend on forward premium or forward discount.

In the above example, suppose Bank of America needs pounds in say three months
and makes a swap arrangement with Llyods. Hence, Bank of America will trade dollars to Llyods and in return will receive pounds. In three months the reverse trade will be realized. That is Bank of America will receive dollars and pay out pounds to Llyods.

Suppose the spot rate is $/L=2.00, and three month forward rate, $F_{t.3} = 2.10$. There is a $0.10 premium on pounds. The three month return on this swap is

$$\frac{F_{t.3} - S_t}{S_t} = \frac{2.10 - 2.00}{2.00} = 0.05.$$ 

To find the annual return, we need to multiply this by 4 (as there are 4 three months in a year). Hence the annual return is $4 \times 0.05 = 0.20$, that is annual return is 20 percent.

Swaps are an efficient way of meeting a bank’s FX needs. To avoid any FX risk, banks try to match the liability created by borrowing foreign currencies with the asset created by lending domestic currency, both to be repaid at the known future exchange rate. This is know as hedging the FX risk.

6 The Futures Market

The futures market is a market where foreign currencies are bought and sold for delivery at a future date. The difference from forward market is that only a few currencies are traded, trading occurs in standardized contracts, and trading occurs in a specific location, such as Chicago Mercantile Exchange. Link: www.cme.com

Contracts mature on the 3rd Wednesday of March, June, September, or December. Contracts come in fixed sizes, such as 100,000 Australian dollars, 62,500 British pounds, etc.

Exchange is just a clearing house in the sense that long positions are matched exactly to short positions.

To take a position (long or short), you post an initial margin. A margin is the amount required with a broker for trading in the futures market. Positions are marked to market each day. Gains and losses are posted in margin accounts. Suppose Euro
September contract requires $10,000 in margin. If the price fell by $0.1 in one day, then this fall represents a loss of $0.1*100,000=$1000 on the $100,000 futures contract. The daily settlement involves deducting this daily loss from the margin deposited with the broker.

*example* Consider the hypothetical movements in a $100,000 euro futures contract, where you take a long position (you buy the contract) and I take a short position (I sell the contract). We each put up $10,000 in margin.

<table>
<thead>
<tr>
<th>Day</th>
<th>Futures price</th>
<th>Contract value</th>
<th>Long-margin</th>
<th>Short-margin</th>
<th>spot rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$0.96</td>
<td>$96,000</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$0.98</td>
</tr>
<tr>
<td>2</td>
<td>$0.93</td>
<td>$93,000</td>
<td>$7,000</td>
<td>$13,000</td>
<td>$0.95</td>
</tr>
<tr>
<td>3</td>
<td>$0.95</td>
<td>$95,000</td>
<td>$9,000</td>
<td>$11,000</td>
<td>$0.97</td>
</tr>
</tbody>
</table>

Say we both unwind our positions on day 3. You have lost $1000 to me. But in the mean time, the spot exchange rate has come down. The futures contract allowed you to avoid currency risk by locking into the euro price of $0.98. This is because at the end of day 3 (assuming for simplicity day 3 is the maturity date or the future contract is reversed at the end of day 3) you can buy euros at 0.96 dollars and sell them in the spot market at 0.97 dollars and make a profit of 1000 dollars.

### 7 Foreign Exchange Options

A foreign exchange option is a contract that provides the right to buy or sell a given amount of currency at a fixed exchange rate on or before the maturity date. This type of option is known as *American* option. There is also what is called *European* options where the contracts are exercised at only maturity date. There two kinds of options. A *call* option gives the holder the right to buy some underlying asset at a prespecified (strike) price during the life of the call. You can buy or sell a call option.
A put option gives the holder the right to sell some underlying asset at a prespecified price during the life of the put. You can buy or sell a put option.

Consider a call option for 100,000 euros with strike price of $1/euro that costs $120. On a per-euro basis the option costs $120/100000=$0.0012. Go long the call if you think that the exchange rate will rise above $1.0012 per euro (the break even point) before the call matures. If this happens, you profit by exercising the option. The counterparty (the person who sold or wrote the call option) has to sell you euros at $1, which are worth more than $1.0012 on the spot market.

Consider a put option for 100,000 euros with strike price $1/euro that costs $120. Go long the put if you think the exchange rate will fall below 1-0.0012=$0.9998/euro (the break even point). The counterparty has to buy euros at $1 which is higher than the spot rate in this case. You make money by buying euros in the spot and selling euros to the counterparty at $1.

An option is said to be in money if the strike price is less than the current spot rate for a call option or greater than the current spot rate for a put option. Usually prices of options in money rise.

### 8 Central Bank Intervention

More on this in the class.