FX Forward Agreements

Buying foreign currency right now is called a spot transaction because it happens immediately (t=0).

But it is also possible to buy foreign currency in the future at an agreed exchange rate that is fixed right now. This is called a foreign exchange forward agreement.

For example, you might be able lock in to sell USD1 million at an exchange rate of JPY102 million in one year. The counter-party to your FX forward rate agreement, usually a bank, will give you USD1 million in exchange for JPY102 million in one year. In this example the FX dealer would say that you are "selling USD 1million forward one year at 102 JPY per USD".

The forward FX rate agreed to by the long and short FX forward traders will be the expected future spot exchange rate. This is why the value of an FX forward is zero when it is first entered into, for both the long and short FX forward traders.

After it's first agreed to, the expected future spot rate may, for example, increase, making the FX forward agreement worth a positive amount to the long trader and a negative amount to the short trader.

FX, Interest Rates and the 'Carry Trade'

Because interest rates on debt vary from country to country, some investors think that borrowing in a country where interest rates are low and investing (lending) in a country where interest rates are high is a good idea to make money. This is called a 'carry-trade'.

The classic carry-trade is to borrow in Japan where short-term interest rate have been close to zero for some decades, and to invest in Australia or New Zealand where interest rates are historically much higher. This investing strategy is not likely to be successful in the future in the long run due to the theory of cross currency interest rate parity.

Cross-Currency Interest Rate Parity

Cross currency interest rate parity (sometimes referred to as IRP) is a theory based on a risk-free arbitrage which goes as follows:

Lending JPY1 million in Japan at the Japanese interest rate (r_{JPY}) for one year must provide a cash flow equivalent to:

- Converting JPY1m to USD at the spot FX rate (divide by $S_{0,JPY/USD}$),
- Lending at the US interest rate (r_{USD}) for one year, and
- Locking in a forward FX agreement now to convert USD to JPY in one year at the forward FX rate (multiply by $F_{1,JPY/USD}$).

Mathematically, this is:

$$JPY1m.\left(1+r_{JPY}\right)^{1} = JPY1m.\frac{1}{S_{0,JPY/USD}}.(1+r_{USD})^{1}.F_{1,JPY/USD}$$

$$\underbrace{\overbrace{V_{0,JPY}}}_{V_{1,JPY}} \qquad \underbrace{\underbrace{\overbrace{V_{0,JPY}}}_{V_{0,USD}}}_{V_{1,USD}} \Bigg\}\, V_{1,JPY}$$

Cancelling the JPY1 million on both sides and re-arranging,

$$F_{1,JPY/USD} = S_{0,JPY/USD} \cdot \frac{(1 + r_{JPY})}{(1 + r_{USD})}$$

Where the forward FX rate is for one year and the interest rates are effective annual rates and risk-free.

The multi-period version of the cross-currency interest rate parity theorem is:

$$F_{T,JPY/USD} = S_{0,JPY/USD} \cdot \frac{(1 + r_{JPY})^{T}}{(1 + r_{USD})^{T}}$$

Common sense-wise, cross currency interest rate parity (IRP) says that expected gains on interest rates by borrowing in a low-interest rate country and lending in a high interest rate

country are likely to be lost when you 're-patriate' your profits, which is when you convert them back to your domestic currency.

So if interest rates in Japan are less than in the US, then the JPY should appreciate against the USD, so the forward FX rate $F_{T,JPY/USD}$ is likely to be lower, so in the future USD1 is likely to buy less JPY.

Calculation Example: Cross-Currency Interest Rate Parity

Question: The current exchange rate is at parity, so:

1 USD = 1 AUD.

The money market rate in:

- Australia in AUD is **4**% pa;
- US in USD it's **3**% pa.

Assume a flat yield curve, that the rates are effective (not simple) annual interest rates and that you can borrow and lend at either rate.

What is the implied **3 year** forward foreign exchange rate?

Answer: Since Australian interest rates are more than in the US, we expect the AUD to depreciate against the USD, so the 3-year forward FX rate $F_{3,USD/AUD}$ should decrease. Remember that the AUD is in the denominator in this forward quote of the AUD, so a decrease in the number will be a depreciation of the denominator currency, the AUD.

To find the exact 3 year forward FX rate:

$$F_{T,USD/AUD} = S_{0,USD/AUD} \cdot \frac{(1 + r_{USD})^T}{(1 + r_{AUD})^T}$$

$$F_{3,USD/AUD} = 1 \text{ USD/AUD} \cdot \frac{(1 + 0.03)^3}{(1 + 0.04)^3}$$

$$= 0.971430324 \text{ USD/AUD}$$

Note that this is an 'American terms' AUD quote, it's "in USD" not "per USD". This is how it's normally quoted in Australia.

In 'European terms' which is "per USD" it would be 1.029409908 AUD/USD, just the inverse of the above.