6

Currency Futures

Any company or individual with dealings in foreign exchange, whether through imports or exports or through inward or outward investments, lending or borrowing, faces some degree of exchange rate risk. Currency forwards or futures are forward or futures contracts with a foreign currency as the underlying. Thus, a contract for the purchase of US dollars denominated in Indian rupees is effectively a contract on the Indian rupee – US dollar exchange rate (referred to as INR: USD). Currency forwards or futures can therefore also be referred to as exchange rate forwards or futures. The basic pricing and trading structure of currency futures and forwards is not different from examples of equity or commodity futures that were seen in previous chapters, but this chapter will explore some of the special features of currency forwards and futures in greater detail. In the foreign exchange markets, a three letter convention is commonly used to refer to currencies – INR for Indian Rupees, USD for US Dollars, GBP for Great Britain Pounds, JPY for Japanese Yen etc.

Typically, hedging needs of smaller firms and for short durations are served better by standardised exchange-traded futures, whereas larger firms with specialised needs and more long-term hedging requirements often go to the forward (OTC) market. Forward contracts are typically entered into through banks, either directly or through a foreign subsidiary. Many India-based multinationals, for example, access INR-USD OTC forwards of various kinds in the Singapore market.

Example 6.1

In March, P Ltd., an importer of paper and pulp machinery has a contractual requirement to pay USD 100 million in September, and any pre- or post-payment is not advantageous from an interest rate or liquidity point of view. The rupee revenue from selling these imported machines in the domestic (Indian) market is more or less predictable but P Ltd. still bears the currency risk due to the amount payable being denominated in a foreign currency. The current exchange rate is INR 60 per USD and the forward rate for September is also INR 60 per USD. (Interest rate on rupees and dollars is assumed to be zero in this example – thus there is neither a carrying cost nor a yield.)

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One possibility is to buy September USD futures for 100 million through an exchange, but this may not be practicable for such a large sum given the illiquidity on the exchanges. More realistically, a forward contract would be executed through a bank.

Assume the margin required by the bank is 10 per cent, and so P Ltd. has to pay

10 per cent × 60 × 100 million = ₹60 crores

as initial margin.

Between the date of the contract and the maturity date, there will be mark-to-market (MTM) margins imposed by the bank as the market exchange rate fluctuates.

If the rupee appreciates, P Ltd. will have to pay additional margins to cover the mark-to-market losses and keep the level of margin at 10 per cent or the agreed proportion to the prevailing market value.

In the month of June, the exchange rate rises suddenly to INR 58 per USD. The loss on the contract is now

(58-60) × INR 100 million = 200 million INR = 20 crore INR.

The net margin available with the bank has diminished when this loss is taken into account. The margin available with the bank is now

(Initial margin – MTM losses) = 60 - 20 crore INR = 40 crore INR.

The bank makes a margin call and requires P Ltd. to deposit a further ₹ 20 crore.

By the time the contract matures in September, the rupee has fallen sharply and is ruling at INR 62 per USD. Since P Ltd's currency forward contract is entered into at a price of INR 60 per USD, P Ltd has to 'deliver' 600 crore rupees in exchange for receiving 100 million dollars. So far it has already paid:

₹ 60 crore in March (initial margin) + ₹ 20 crore in June (margin call)= ₹ 80 crore.

Therefore it now has to deliver the balance, i.e., ₹ (600-80) crore = ₹ 520 crore.

Had this been a futures contract, an alternative would be to 'square off' the transaction. In this case, P Ltd would sell 100 million USD at 62 and thus offset its earlier purchase. It would receive the nett amount of (62-60) x 100 million = 200 million INR or ₹ 20 crore as its profit on the currency hedge. This would offset the extra cost it would incur when making the payment to the US. Had P Ltd. remained unhedged, it would have ended up paying ₹ 620 crore to meet its liability. By hedging, it was able to fix its liability at ₹ 600 crores.

Currency prepaid forwards

As seen in Example 6.1, forwards or futures are settled at the time of expiry either:

- by delivering the agreed amount of local currency (at the rate fixed in the forward or futures contract) or

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- by squaring off the contract by selling the same quantity and paying (or receiving) the difference between the exchange rate on the settlement date and the exchange rate at which the contract was entered into.

However, it is also possible to make the main payment now rather than later. Such instruments and/or contracts are called, not surprisingly, currency pre-paid forwards. Suppose in Example 6.1, the interest rate in rupees is 10 per cent per annum; for six months the rate applicable is 5 per cent (ignoring compounding). Assume that the forward rate (i.e., exchange rate on the forward market) is INR 60 per USD. The amount to be pre-paid in such an instrument after adjusting for the time value of money would be (₹ 600 crore/1.05)= ₹ 571 crore.

Pricing of currency futures: Covered interest arbitrage

In chapter 4, it was noted that the relationship between spot and forward prices is given by the following formula:

$$F \leq S + C - Y$$

In the case of currency futures, there are no storage costs and no convenience yields. However, there is a carrying cost reflecting the interest rates on the currency being sold and a real yield reflecting the interest rate on the currency being bought (this will be explained below). The carrying cost and the yield can be simply calculated by multiplying the interest rate by the amount involved (i.e., the spot price). Both of these are proportional to the spot rate and there are no lump sum costs like warehouse rents which might occur for commodities. Therefore, the carrying cost and yield can be calculated as percentages of the spot rate. Foreign exchange is not subject to discontinuities in production or storage. Thus, the expectations approach to pricing is generally irrelevant. Therefore, foreign exchange futures, like other financial futures, generally reflect the carrying cost approach to futures pricing and the formula becomes an equation rather than an inequality:

$$F = S + C - Y$$

i.e., $F = S + (C-Y)$

i.e., $F = S + S\,(c_t - y_t)$

i.e., $F = S(1 + c_t - y_t)$

where, F = forward exchange rate

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S = spot exchange rate

C = carrying cost for the period t (absolute amount)

Y = yield for the period t (absolute amount)

c_t = risk free interest rate on currency being sold (usually domestic currency) for the time t

y_t = risk free interest rate on currency being bought (usually foreign currency) for the time t

This formula ignores the compounding factor. If continuous compounding is used it can be shown mathematically that the formula becomes:

$F = (S\text{-}I)e^{rt}$ [or] $F = Se^{c-y}$

Where,

$I = Y - C$ (this term may be positive or negative depending on the relative interest rates in the two currencies)

r = risk free rate of interest per annum (generally taken as the Treasury bill rate) on currency being sold

t = time period measured in number of years involved (e.g., three months =0.25)

e is the mathematical term (similar to π) known as Euler's number or the exponential constant (approximately equal to 2.7182818282 or 2.718).

$c = r$ = risk free interest rate per annum in the currency being sold (usually domestic currency)

y = risk free interest rate per annum in the currency being bought (usually foreign currency)

t = time period involved in years

Though the continuous compounding formulae call for the use of the risk free interest rate, if data is not available, or even otherwise, a suitable approximation (such as the LIBOR in that currency) can be used without seriously affecting the calculations.

What this formula indicates is that a forward currency exchange rate is a result primarily of the *difference in interest rates between the two relevant currencies*. If one ignores transaction costs and any risk of default, this is all that the forward exchange rate comes down to. It follows that:

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a. Currencies having lower interest rates have their future or forward prices at a premium (contango) compared to the spot exchange rate. The interest rate on the dollar is generally lower than on the rupee. Therefore, the forward exchange rate of the dollar (denominated in rupees) will be higher than the spot rate. For example, if the USD is at 55 INR today, the one year forward rate is likely to be around 60.5 INR if the USD interest rate is 10 per cent lower than the INR interest rate. In terms of the formula,

$F = S + C - Y$, i.e., $F = S + S\,(c_t - y_t)$

i.e., $F = 55 + 55$ (10per cent) $= 60.5$

b. Currencies with higher interest rates will have a forward rate which is lower than the spot rate. In the INR case if there was a forward market for a currency which has a higher interest rate than India, the forward exchange rate in INR would be lower than the current exchange rate, i.e., the forward rate would be at a discount (backwardation) *vis-à-vis* the spot exchange rate. (In exchange rate theory, this is known as 'covered interest rate parity'.)

Synthetic forward contract

One can also indirectly or 'synthetically' create a *de facto* currency future instrument by lending in one currency and borrowing in another.

Example 6.2:

X wants to have 100,000 USD three months from now, while fixing the cost in rupees today. He can borrow the appropriate amount of rupees now and buy the dollars. The INR-USD rate is 50, the interest rate in rupees is 8 per cent per annum, and the interest rate in dollars is 2 per cent per annum. Ignore transaction costs and fees. How should this be done?

Solution

X needs 100,000 USD in three months. The annual interest rate in dollars is 2 per cent, so for three months it is 0.5 per cent. This means that

100,000 / 1.005 = 99,502 USD

needs to be bought right now. This will earn interest and become $100,000 in three months.

To get 99502 USD, he needs to borrow:

99502 × 50 (current exchange rate) = 49,75,100 INR

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With a rupee interest rate of 8 per cent per annum, for three months he will have to pay 2 per cent (a quarter of 8 per cent). The total amount he will have to pay including interest is:

49,75,100 × 102 per cent = ₹ 50,74,602.

This is sufficient to hedge the liability. Effectively, by paying ₹50.75 lakhs (approximately) he has obtained $100,000 three months from now. He has effectively got a fixed forward exchange rate without entering into any derivative or forward contract. The net three month forward exchange rate in the example works out to 50.75 which is nothing but,

$$F = S + S(c_t - y_t) = 50 + (2\text{per cent} - 0.5\text{per cent})50 = 50.75.$$

Note that Example 6.2 did not involve any derivative transaction. This is called 'covered interest arbitrage'. This mechanism, by providing an arbitrage mechanism, ensures that the forward price will always adhere to the equation set out earlier: in the event of any deviation, market participants can borrow rupees and buy spot dollars (as in Example 6.2) and then sell the dollar forwards and make a riskless profit. For instance, if the forward exchange rate for a three month period is 51 instead of 50.75, one can buy dollars on the spot, incur interest in rupees (with a total cost of 50.75 as per Example 6.2) and then sell dollars in the forward market and collect ₹ 51, earning a riskless profit of ₹ 0.25. This involves buying spot and selling forward – it will raise the spot exchange rate and reduce the forward rate until the forward rate becomes equal to the rate indicated by covered interest arbitrage.

The above calculations ignored compounding. For a more accurate calculation, one should use continuous compounding. The fixed-rupee cost that needs to be repaid after the required duration is:

$$Q \times Se^{(c-y)t}$$

Where,

Q is the amount in the foreign currency needed after t (in years) time [foreign currency being the one against whose variations a hedge is required]

c = (risk free) domestic currency interest rate per annum

y = (risk free) foreign currency interest rate per annum

S = spot exchange rate (number of domestic currency units needed to buy one foreign currency unit right now)

t = number of years after which the foreign currency is needed

e = Euler's number

In Example 6.2, this would be $100{,}000 \times 50 \times 2.718^{(.08-.02)\,0.25}$ = 50,75,565 which is about ₹ 963 more than the 'non-compounding' calculation above (an error of less than 2 in 10,000 parts).

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Carry trade

The term 'carry trade' simply means to borrow in a low-interest rate currency and invest in either short term deposits in a currency with a higher interest rate or other high yield assets in that currency. The idea is to borrow at a lower rate and lend at a higher rate. The risk is that the exchange rate may change. The hope behind the carry trade is that the borrowed currency will not appreciate or only appreciate slightly in such a way that the appreciation is less than the extra interest earned. In the carry trade, there can sometimes be both an interest rate gain and a currency gain if the borrowed currency depreciates in value.

According to the 'rational expectations' and 'efficient markets' hypotheses of economic theory, the market should theoretically never allow a free lunch; therefore any gains from carry trade over time are likely to be wiped out because of the inherent currency risk. The real world does not necessarily conform to these hypotheses. Currencies have been known to remain under- or over-valued relative to expected levels for long periods of time. Hence the patient, long-term and careful speculator or investor may well be successful in the carry trade. (Note however that the word used is 'may' rather than 'will' and it is equally possible for the carry trade to end in losses.)

As an example, many emerging market Asian government bonds may not be as risky as indicated by various US-centric credit rating agencies, whose rating changes often turn out to be lagging not leading indicators. If one takes this view, then he could borrow by shorting yen or dollar and investing in a diversified portfolio of Asian bonds, among other assets, hoping to profit from the unfairly high risk premia attached. Of course, there is no guarantee that such trades will be successful.

Empirical evidence has shown that returns from carry-trades show negative skew and kurtosis. In other words, carry trade strategies are profitable on the whole but are interspersed with huge losses from time to time. So, carry trades may eventually amount to picking pennies in front of a road roller.

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