

# Notes on foreign exchange exposure and forex derivatives

Vinod Kothari

$R_d$  - domestic risk free rate  
 $R_f$  - foreign risk free rate  
 $S$  - spot exchange  
 $F$  Forward exchange rate

## ***Determination of exchange rates:***

### **Interest rate parity theory**

The interest rate parity theory is built on the argument of no-arbitrage possibilities in financial markets.

Suppose the present rate of USD: rupee is 1: 50. Suppose the risk free rate of return in India is 6% and the that in USA is 3%. If I have Rs 100 to invest, there should be no difference between the value that I have whether I invest the money in India or in the USA, assuming no frictions/restrictions on capital movements, etc.

So, if I convert my wealth into USD and then invest 2 dollars at the US risk free rate, I will have, at the end of 1 year  $(1+3\%)*2 = \$2.06$ . If invested Rs 100 in Indian risk free rate, it would be  $100*(1+6\%) = 106$ . So, the forward exchange rate would equate the value of Rs 106 to USD 2.06. In other words, the exchange rate would be 51.4456.

That is to say,

$$100/S * (1 + R_f)^n * F = 100 * (1 + R_d)$$

To formulate as a general equation:

$$(1 + R_d)^n = F/S * (1 + R_f)^n \quad (1)$$

Alternatively

$$F = (1 + R_d)^n / (1 + R_f)^n * S \quad (2)$$

This would essentially mean that one of the prime reasons for changes in exchange rates is interest rates – higher the interest rates in an economy, the exchange rate would continue to worsen.

Equation (2) may be written in continuous form

$$F = e^{R_d n} / e^{R_f n} * S \quad (3)$$

### **Hedging of risk in forex markets:**

The usual devices for hedging of risk in the foreign exchange markets are as follows:

- Forwards – most common practice is buy outright forwards.
- **Money market hedge:** Money market hedge refers to a hedge created by borrowing in the currency of the expected receivable, converting the money at spot rates, investing the money in local currency. The loan in foreign currency can be repaid from out of the receivable. Effectively, therefore, the receivable is preponed by borrowing its present value. A money market hedge will mostly be less advantageous than an outright forward, because the recipient uses the borrowing rate in foreign currency, while the forward market is based on risk free interest rates in the two currencies.

### **Manner of quoting forward rates:**

It is common to see forward quotes like this:

	<i>Bank A</i>	<i>Bank B</i>
<i>SPOT</i>	<i>USD/CHF 1.4650/55</i>	<i>USD/CHF 1.4653/60</i>
<i>3 months</i>	<i>5/10</i>	
<i>6 months</i>	<i>10/15</i>	

First of all, the forward quotes are the quotes are in points or “pips”, that is, 4<sup>th</sup> decimal points. So, 5 points equals 0.0005. Now, an important point to understand – there are two points given – if the later point is higher than the former point, the quote is in premium and the forward pips will be added to the spot price. If the second point is lower than the former, the points are deductible from the spot price.

### **Exercises:**

#### **1. Nov 2009**

*(a) M/s Omega Electronics Ltd. exports air conditioners to Germany by importing all the components from Singapore. The company is exporting 2,400 units at a price of Euro 500 per unit. The cost of imported components is S\$ 800 per unit. The fixed cost and other variables cost per unit are Rs. 1,000 and Rs. 1,500 respectively. The cash flows in Foreign currencies are due in six months.*

*The current exchange rates are as follows*

*:*

<i>Rs/Euro</i>	<i>51.50/55</i>
<i>Rs/S\$</i>	<i>27.20/25</i>

After six months the exchange rates turn out as follows:

Rs/Euro                      52.00/05  
 Rs/S\$                         27.70/75

(1) You are required to calculate loss/gain due to transaction exposure.

(2) Based on the following additional information calculate the loss/gain due to transaction and operating exposure if the contracted price of air conditioners is Rs.25,000 :

(i) the current exchange rate changes to  
 Rs/Euro                      51.75/80  
 Rs/S \$                         27.10/15

(ii) Price elasticity of demand is estimated to be 1.5

(iii) Payments and receipts are to be settled at the end of six months

cost of imported components	800	27.25	52320000	27.75	53280000
fixed cost			2400000		2400000
variable cost			3600000		3600000
total			58320000		59280000
sales	500	51.5	61800000		62400000
profit			3480000		3120000
					360000
					25000
<b>If contracted price Rs 25000</b>					
original price in euros					485.4368932
revised price					483.0917874
change in quantity sold					\$ 2,417.4757
or roughly					2417

	Qty	original rate	total	revised Qty	rate	total
Hence						
Raw materials	2400	27.25	52320000	2417	27.75	53657400
fixed costs			2400000			2400000
variable costs			3600000			3625500
sales	2400	51.5	60000000	2417	52	60716908
profit			1680000			1034008.2
						645991.79

Note; Suggested answer of the ICAI is wrong as the fixed cost remains fixed cost.

(a) Your forex dealer had entered into a cross currency deal and had sold US \$ 10,00,000 against EURO at US \$ 1 = EUR 1.4400 for spot delivery. However, later during the day, the market became volatile and the dealer in compliance with his management's guidelines had to square – up the position when the quotations were:

Spot US \$ 1	INR 31.4300/4500
1 month margin	25/20
2 months margin	45/35
Spot US \$ 1 EURO	1.4400/4450
1 month forward	1.4425/4490
2 months forward	1.4460/4530

What will be the gain or loss in the transaction?

Question may be solved by obtaining corss currency ra		
Euros bought for 1 dollar		1.44
rupees to be paid for 1 dollar		31.45
hence, rupees per euro		21.84028
loss in euros		5000
loss in rupees		109201.4

(b) On 19th April following are the spot rates

Spot EUR/USD 1.20000 USD/INR 44.8000

Following are the quotes of European Options:

Currency Pair	Call/Put	Strike Price	Premium	Expirydate
EUR/USD	Call	1.2000	\$ 0.035	July 19
EUR/USD	Put	1.2000	\$ 0.04	July 19
USD/INR	Call	44.8000	Rs. 0.12	Sep. 19
USD/INR	Put	44.8000	Rs. 0.04	Sep. 19

(i) A trader sells an at-the-money spot straddle expiring at three months (July 19). Calculate gain or loss if three months later the spot rate is EUR/USD 1.2900.

put option sold strike price	actual	call option sold strike price	actual	gain/loss p	gain/loss o
1.2	1.29	1.2	1.29	0.04	-0.055
		loss			-0.015

You have following quotes from Bank A and Bank B:

	<b>Bank A</b>	<b>Bank B</b>
<i>SPOT</i>	<i>USD/CHF 1.4650/55</i>	<i>USD/CHF 1.4653/60</i>
<i>3 months</i>	<i>5/10</i>	
<i>6 months</i>	<i>10/15</i>	
<i>SPOT</i>	<i>GBP/USD 1.7645/60</i>	<i>GBP/USD 1.7640/50</i>
<i>3 months</i>	<i>25/20</i>	
<i>6 months</i>	<i>35/25</i>	

Calculate :

- (i) How much minimum CHF amount you have to pay for 1 Million GBP spot?  
(ii) Considering the quotes from Bank A only, for GBP/CHF what are the Implied Swap points for Spot over 3 months?

If the both the currencies are bought from the same bank, the rates are like this:

		Bank A	Bank B
1 pound equals	USD	1.766	1.765
CHF need to buy a USD		1.4655	1.466
CHF to pound		2.588073	2.58749

However, it would be better to USD from bank A and then buy pounds from Bank B  
In that case, the cost is

		Bank A	Bank B	lower
1 pound equals	USD	1.766	1.765	1.765
CHF need to buy a USD		1.4655	1.466	1.4655
CHF to pound		2.588073	2.58749	2.586608

Computation of swap points for 3 months' forward

	3 month forward	
	bid	offer
USD/CHF	1.465	1.4655
forward points	5	10
forward rate	1.4655	1.4665
GBP/USD	1.7645	1.766
forward points	25	20
forward rate	1.762	1.764
GBP/CHF spot	2.584993	2.588073
GBP/CHF forward	2.582211	2.586906
	-27.815	-11.67

So, there implied swap points for 3 months are 28/12

*(a) An exporter is a UK based company. Invoice amount is \$3,50,000. Credit period is three months. Exchange rates in London are :*

*Spot Rate (\$/£) 1.5865 – 1.5905*  
*3-month Forward Rate (\$/£) 1.6100 – 1.6140*

*Rates of interest in Money Market :*

	<i>Deposit</i>	<i>Loan</i>
\$	7%	9%
£	5%	8%

*Compute and show how a money market hedge can be put in place. Compare and contrast the outcome with a forward contract.*

Money market hedge can be created by the UK company borrowing in USD for 3 months, and investing the money locally, at pound deposit rates.

Amount borrowed	342298.3
converted into pounds	215214.3
invested at	5%
after 3 months	217904.4
if forward transaction is done	216852.5

Hence, money market hedge is better.

*An Indian exporting firm, Rohit and Bros., would be cover itself against a likely depreciation of pound sterling. The following data is given :*

*Receivables of Rohit and Bros : £500,000*

*Spot rate : Rs.56,00/£*

*Payment date : 3-months*

*3 months interest rate : India : 12 per cent per annum*

*: UK : 5 per cent per annum*

*What should the exporter do ? (6 Marks)*