ACF305
International Financial and Risk Management

Week 7 tutorial

Question 1

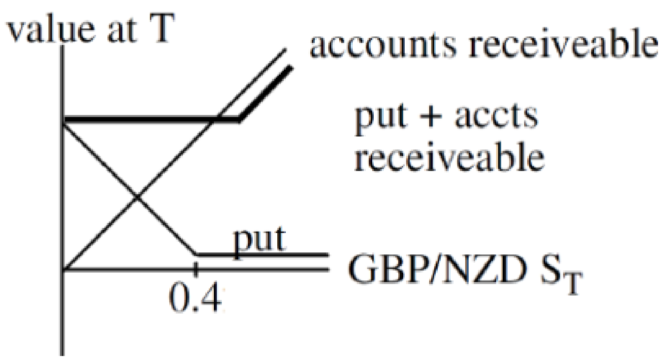
Assume that the contracts discussed below are described with the GBP as the home currency and that the option's expiration date matches the expiration date of the cash flow to be hedged. Illustrate how the exchange rate affects the GBP value of:

a) An NZD 500,000 accounts receivable and a purchase of ten puts each worth NZD 50,000 with a strike price of GBP/NZD 0.42.

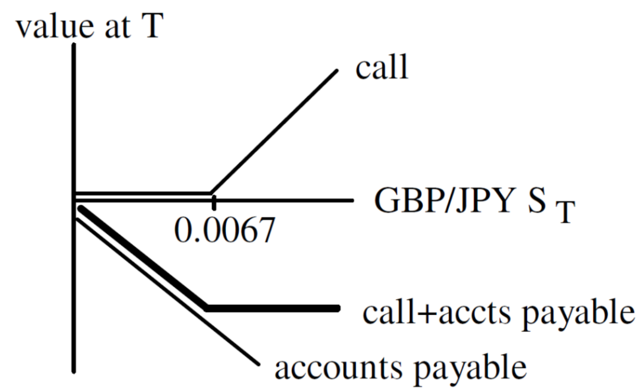
b) A JPY 10,000,000 accounts payable and a purchase of ten calls each worth JPY 1,000,000 with a strike price of GBP/JPY 0.0067.

Solution

(a)



(b)



$$\text{Max}\{X - S_T, 0\} + S_T$$

$$\text{Max}\{S_T - X, 0\} - S_T$$

Question 2

The Thailand Plettery Steel Company has a debt of NZD 100,000, which is repayable in twelve months. Plettery's controller Jane Due is having trouble sleeping at night knowing that the debt is unhedged. The current THB/NZD exchange rate is 20, and p.a. interest rates are 21 percent on THB and 10 percent on NZD. Jane is considering a forward hedge (at $F_{t,T} = 20 \times 1.21/1.10 = 22$), but a friend tells her that he recently bought a call on NZD 100,000 with $X = 20$, and is willing to sell it to her at the historic cost, THB 1 per NZD or THB 100,000 for the total contract. What should she do?

Solution

The call premium asked by her friend violates the lower bound and therefore she should accept the offer. A forward contract at $X = 20$ has a value of $(22 - 20)/1.21 = 1.653$. Since, unlike a forward contract at $X = 20$, the option cannot have a negative time value, it should be worth more than that.

$$20/1.10 - 20/1.21 = (20 \times 1.21/1.10 - 20)/1.21 = (22 - 20)/1.21$$

Question 3

Assume that the interest rates are 21 percent and 10 percent p.a. in Thailand and Switzerland, respectively. Consider a call and a put at X = THB/CHF 21.

a) What is the lower bound for European-style options with lives equal to $T - t$ = 1 year, 6 months, 3 months, and 1 month, when S_t = 18, 20, 22, and 24, respectively?

b) If S_t = 20, $r_{t,T}$ = 0 .21, $r^*_{t,T}$ = 0.10, a one-year call with X = THB/CHF 20 priced at 1 is undervalued. Show that there is an arbitrage opportunity.

Solution

a) For the call, first compute the value of the forward contract at $X = 21$:

$$\frac{S_t}{1+(T-t)\times 0.10} - \frac{21}{1+(T-t)\times 0.21}$$

$S_t =$	18	20	22	24
Life = 12 months	-0.99	0.83	2.64	4.46
6 months	-1.86	0.04	1.85	3.85
3 months	-2.39	-0.44	1.51	3.46
1 month	-2.79	-0.8	1.18	3.16

Next, add the bound $C_t > 0$ which becomes relevant when the value of a comparable forward is negative. The option's intrinsic value becomes a minimum value:

$S_1 =$	18	20	22	24
Lower bounds:				
Life = 12 months	0	0.83	2.64	4.46
6 months	0	0.04	1.85	3.85
3 months	0	0	1.51	3.46
1 month	0	0	1.18	3.16
Intrinsic value:	0	0	1	3

At $S_T = 24$ the call is almost a forward purchase contract (the call is priced close to its lower bound). Its value still exceeds the intrinsic value and exercising is never optimal. An American call will therefore be priced as if it were European. In this example, the reason is that the foreign interest rate is far below the domestic rate.

For the put, first look at the values of comparable forward sales contracts, and these are the same as the above values of the purchase contracts, except for the sign. The non-negativity bound yields the following floor for our various put prices:

$S_1 =$	18	20	22	24
lower bounds:				
life = 12 months	0.99	0	0	0
6 months	1.86	0	0	0
3 months	2.39	0.44	0	0
1 month	2.79	0.8	0	0
intrinsic value:	3	1	0	0

At $S_T = 18$ the (European) put is almost certain to be exercise and therefore trades near the value of a forward sale. Its value would be below the intrinsic value. Given this, an American put would already have been exercised. Therefore, early exercising of the put does not have an ex ante probability equal to zero and all “alive” American puts must trade above European put prices. If the foreign rate had far exceeded the domestic interest rate, you would not have observed this.

b) Same as Question 2 above.