FEEDBACK

Range Box Redux

I was impressed with the recent article on the "Year of the Range Box". I'd like to add some comments. As the article mentioned, a tiny move may have a gigantic effect on the liabilities of the dealer. This is bound to cause "misunderstandings" between the dealer and the client. Has the barrier really been touched? As the article mentioned, this may not be shared knowledge on both sides. The dealer may call the client and say: "On Thursday afternoon, while you were out, the dollar has reached 113.05 Yen and therefore, I owe you nothing". The client may have missed seeing that price on his screen.

There are several methods by which the can be handled:

- There should be confirmations from at least three different brokers that the barrier has indeed been breached
- Only daily (or weekly) closing prices should be eligible for breaking the barrier. This, of course, affects the valuation of the options. A similar phenomena exists in Asian options where the frequency of the averaging affects the price

To truly understand box trades, it is instructive to consider a single double barrier call option. A double barrier option is a normal option. However, should the underlying currency ever stray from a band, the option gets "knocked out" and the investor loses their premium. The option will be knocked out if the underlying falls beneath a certain level or rise above another level.

Let us study such an option, say a Double Barrier DM call struck at 1.55 for three months, with the bottom barrier at 1.45 and the top at 1.70. The current spot price is 1.55

So long as the DM exchange rate stays in the range 1.45 to 1.70, the investor owns a call option struck at 1.55. However, if at any time during the life of the option, the exchange rate falls below 1.45 or rises above 1.70, the investor loses the entire option.

Unlike a standard call option which can have an unlimited payoff at expiry, the double barrier CANNOT pay more than 0.15. That is because, if the exchange rate ever rises above 1.70, the option gets knocked out. For the investor, the best of all worlds would be to have the underlying at 1.6999 just at expiry. The payoff than would be 0.1499, just under 0.15.

This option has some very interesting "Greeks". A vanilla call option is short theta and is long vega. That is to say, every day the option loses some of its value due to time decay. On the other hand, increases in volatility increase the value of the option.

A double barrier call option has two conflicting effects:

1) The embedded call option is short theta and long vega, as above.

2) The barriers have the effect of being long theta and short vega. The investor likes time to pass so long as the option is alive since it has a smaller chance of being knocked out. Similarly, the investor "hates" volatility. The more volatile the markets, the higher the chance of being knocked out.

Does the double barrier have positive vega or a negative one? How about theta? The answer depends on which of these two effects wins.

Let us look at some numerical examples where the investor is long 100 options.

Scenario Number	Time to expiry	Underlying Price	Vol	Option price	Delta	Vega
1	3 months	1.55	9%	1.94	0.30	0.037
2	3 months	1.65	9%	2.82	-0.35	-0.59
3	10 days	1.65	9%	9.28	0.37	-0.33
4	10 days	1.69	9%	3.75	-2.75	-0.50
5	10 days	1.69	8%	4.31	-3.05	-0.63
6	2 days	1.69	8%	9.29	-4.28	-0.90
7	2 days	1.65	8%	9.98	1.06	about zero

A dealer who is short a Double Barrier has a very difficult time delta hedging. Between scenarios #3 and #4, the dealers have to change their positions in the underlying from long to short. In scenario #5, volatility has decreased and the dealer has to make enough money to cover the cost of the option. But the dealer has less of an opportunity to do so since volatility has declined.

Scenarios #6 and #7 show the extreme sensitivity of delta to the price of the underlying. Observe that the underlying changed by just four points but delta changed from -4.28 to 1.06. Extremely difficult to delta hedge. Of course, the Gamma in these scenarios is quite large. When the dealer is short both a double barrier call and a double barrier put the hedging problems are even more profound.

IZZY NELKEN
SUPER COMPUTER CONSULTING