WORLD 1 / CHAPTER 4

RISK FACTORS IN OPTION DEALING

page

1. Risk factors in option dealing

The profit and loss results described so far always assume that the option is held till expiry. On the following pages we describe the factors influencing the options position during the term of the option.

I. Delta

If the underlying price increases, the call price increases too. The delta of a call shows by how much the call price increases if the underlying increases.

The delta shows the change in the option price once there is a small change in the underlying. Mathematically the delta is the first derivation of the option price formula by the underlying. As the call changes in the same direction than the underlying, the delta of a call is positive. By similar reasoning, the delta of a put is negative.

The delta of an option has values in the range of -1 and +1. A call with a delta of 1, implies that the option price increases by 1 unit.
A delta of 0, means that there is no change in the option price if the underlying price changes.

$$DELTA = \frac{Change\ in\ option\ \ price}{Change\ in\ underlying}$$

For the different option types the following deltas can be observed:

Delta sign	*Call*	*Put*
Long options	(+)	(–)
Short options	(–)	(+)

Example

A delta of +0.5 (50%) for a GBP/USD call means that if GBP/USD increases by 1 Cent, the call price increases by 0.5 Cent.

Delta play also an important role in hedging. Delta Hedfing is the hedging of an option position by a position in the underlying. The gain/loss of the option is offset by the loss/gain in the underlying. The amout of the underlying is calculates by multiplying delta with the number of option contracts.
In oreder to delta-hedge a long call or short put you sell the underlying, for a short call and long put you buy the underlying.

Example

You have bought a USD call/ CHF put USD 1,000,000, Strike 1.46. The Delta is 0.5. What is your Delta-hedge?

1. You are USD Call long.
2. With a long Call the proper hedge is USD short in the underlying
3. With delta 0.5, you have to sell 1,000,000 x 0.5 = USD 500,000 in the spot market.

II. Gamma

As the delta shows the change in the option price for a small change in the underlying, it can only serve as a snapshot calculation.

The next question to be answered is, how delta changes if the price of the underlying changes. This factor is called gamma.

Since Gamma measures the change of delta it is strongest where delta is most volatile. This is at-the-money and with short time to maturity.
Is delta near 0 or (±) 1, a change in the underlying does not influence considerably the delta position since the option stays still deep out of the money or in the money.
The gamma shows the expected change in delta for a small change in the price of the underlying.

Delta can be compared to the speed and gamma to the acceleration. Gamma can also be taken as a measure of stability of the delta.

$$Gamma = \frac{Change\ in\ delta}{Change\ in\ underlying}$$

Gamma sign	*Call*	*Put*
Long options	(+)	(+)
Short options	(–)	(–)

III. Theta

The longer the term, the more expensive the option. Therefore the price of an option has to decrease with the lapse of time (all other factors being stable).

Theta is strongest for at the money and short-term options. Theta is for short time to maturities very strong (=time decay very high). If the life of the option is reduced by one day it will have little influence on the option price if the remaining time is one year. If though the remaining term is very short, the time value of the option deteriorates very quickly. In case of one day to maturity the whole time value is gone at the following day.
For deep in the money options the premium consists mainly of the intrinsic value, for deep out of the money value a symbolic premium is paid. In both cases the time value of the option is very low and changes in the time to maturity have neglibile influence on the option price.

The change in the option price with the passage of time is called theta. A positive theta means, that the value of the option position is getting better as time goes on. A negative theta means that with time passage, the position value decreases.

Theta sign	*Call*	*Put*
Long options	(–)	(–)
Short options	(+)	(+)

IV. Vega (Kappa)

One of the most important influencing factors on the option price is the volatility. The question in risk measurement is, how much a change in volatility implies a change in the option price. This change is called vega (or kappa).

$$Kappa = \frac{Change\ in\ option\ \ price}{Change\ in\ volatility}$$

A positive vega tells us that the option position is improving in value if volatility increases. A negative vega means that we are losing in our option valuation as the volatility decreases. Higher volatilities lead to higher call and put premiums. For the seller of options this means that he is losing money and that the buyer of options is gaining money if volatility increases. For deep in the money options the premium consists mainly of the intrinsic value.Since the intrinsic value does not change if the the volatilioty changes, a change of the volatility does not influence the option price strongly in this case .

Also deep out the money options are hardly influenced by volatility changes since the low premium will not change if the insecurity in the markets rise.

Vega sign	*Call*	*Put*
Long options	(+)	(+)
Short options	(–)	(–)

Option strategies are often described with their volatility view. According to this volatility is 'bought' or 'sold'. Buying volatility means that you profit from an increase in volatility; to sell volatility means that you profit from a decline in volatility. If volatility is the only undetermined measure in the option pricing formula, most option strategies may be reduced to views about the volatility.

V. Epsilon/Rho

As shown in the section on option pricing, interest rates (for both currencies) have an influence on the option price. The epsilon of FX options shows the influence of a change in interest differential on the option premium.