



APPENDIX 14

WORKED EXAMPLE OF DELTA-PLUS METHOD OF CALCULATING OPTIONS RISK MARKET RISK CAPITAL ADEQUACY

1. Assume that a bank has an European short call option on a commodity with an exercise price of 490 and a market value of the underlying 12 months from the expiration of the option at 500; a risk-free interest rate of 8% per annum, and the volatility at 20%. The current delta for this position, calculated according to the Black-Scholes formula is -0.721 (i.e., the price of the option changes by -0.721 if the price of the underlying moves by 1). The gamma is -0.0034 (i.e., the delta changes by -0.0034, i.e. from -0.721 to -0.7244, if the price of the underlying moves by 1). The current value of the option is 65.48.

2. The following steps show how the capital charges are calculated according to the delta-plus method:

- a) The first step is to multiply the market value of the commodity by the absolute value of the delta:

$$500 \times 0.721 = 360.5$$

The delta-weighted position then is incorporated into the measure described in the Capital Adequacy Module of the Rulebook. If the bank uses the maturity ladder approach and no other positions exist, the delta-weighted position is multiplied by 0.15 to calculate the capital charge for delta:

$$360.5 \times 0.15 = 54.075$$

- b) The capital charge for gamma is calculated according to the formula set out in the Capital Adequacy Module of the Rulebook:

$$0.5 \times 0.0034 \times (500 \times 0.15)^2 = 9.5625$$

- c) The capital charge for vega has to be calculated. The assumed current (implied) volatility is 20%. As only an increase in volatility carries a risk of loss for a short call option, the volatility has to be increased by a relative shift of 25%. This means that the vega capital charge has to be calculated on the basis of a change in volatility of 5 percentage points from 20% to 25% in this example. According to the Black-Scholes formula used here, the vega equals 168. Thus a 1% or 0.01 increase in volatility increases the value of the option by 1.68. Accordingly, a change in volatility of 5 percentage points increases the value by:

$$5 \times 1.68 = 8.4$$

Which is the capital charge for vega risk.