Options Trading Greeks and P&L Formulas

The Greeks

Delta$_\$$: $ value of underlying needed to delta hedge the position

$$\text{Delta}_\$ = \text{qty} \times \text{delta} \times \text{forward}$$

**Gamma$_\$$**: Change in Delta$_\$$ for a 1% multiplicative spot bump

$$\text{Gamma}_\$ = \text{qty} \times \text{gamma} \times \left(\frac{\text{forward}^2}{100}\right)$$

Vega$_\$$: Change in $ price for 1% additive vol bump

$$\text{Vega}_\$ = \text{qty} \times \left(\frac{\text{vega}}{100}\right)$$

Annualized Vega$_\$$: change in $ price for a $\frac{1\%}{\sqrt{t}}$ additive vol bump, where t is time to maturity in years

$$\text{Annualized Vega}_\$ = \text{Vega}_\$ \times \left(\frac{1}{\sqrt{t}}\right)$$

Normalized Root Vega: using 3mo 50d IV

$$\text{Vol Vega}_\$ = \text{Annualized Vega}_\$ \times \left(\frac{\text{IV}(50\text{d}, 3\text{mo})}{0.16}\right)$$

**Vanna$_\$$**: Change in Vega$_\$$ for 1% spot bump

$$\text{Vanna}_\$ = \text{qty} \times \left(\frac{\text{vanna}}{100}\right) \times \left(\frac{\text{forward}}{100}\right)$$

**Volga$_\$$**: Change in Vega$_\$$ for 1% additive vol bump

$$\text{Volga}_\$ = \text{qty} \times \left(\frac{\text{volga}}{10000}\right)$$

Theta$_\$$: Change in $ price when moving time forward by 1-day

$$\text{Theta}_\$ = \text{qty} \times \text{theta} \times \left(\frac{1}{365}\right)$$

Rho$_\$$: Change in $ price for 1bp rate bump (doesnt apply to us)

$$\text{Rho}_\$ = \text{qty} \times \text{rho}$$

**Charm$_\$$**: Change in Delta$_\$$ when moving time forward by 1-day

$$\text{Charm}_\$ = \text{qty} \times \text{forward} \times \text{charm} \times \left(\frac{1}{365}\right)$$

Adjusted Delta with vol skew effect where δVol is the sensitivity of implied volatility to log-forward moves (commonly parametrized by the skew slope ratio, SSR = 1.3)

$$\text{Adjusted Delta}_\$ = \text{Delta}_\$ + \text{Vega}_\$ \times 100 \times \delta\text{Vol}$$

P&L Attribution

Forward Move: in %
Vol Move: Implied volatility move (in difference)
Rate Move: expressed in difference

$\text{PL}_{\textbf{delta}} = \text{BoD}_{\text{delta}} \times \text{ForwardMove}$

$\text{PL}_{\textbf{gamma}} = \text{BoD}_{\text{gamma}} \times \frac{1}{2} \times 100 \times (\text{ForwardMove})^2$

$\text{PL}_{\textbf{theta}} = \text{BoD}_{\text{theta}} \times \frac{\text{Change in Time}}{365}$
i.e. $\frac{1}{365}$ *for a day*

$\text{PL}_{\textbf{vega}} = \text{BoD}_{\text{vega}} \times 100 \times \text{VolMove}$

$\text{PL}_{\textbf{vanna}} = \text{BoD}_{\text{vanna}} \times 10000 \times \text{VolMove} \times \text{ForwardMove}$

$\text{PL}_{\textbf{volga}} = \text{BoD}_{\text{volga}} \times \frac{1}{2} \times 10000 \times (\text{VolMove})^2$

$\text{PL}_{\textbf{rho}} = \text{BoD}_{\text{rho}} \times 10000 \times \text{RateMove}$

$\text{PL}_{\textbf{delta hedged}} = \text{BoDPL} - \text{PL}_{\text{delta}}$
where BoD PL is the PL made of BoD position

$\text{PL}_{\textbf{greeks}} = \text{PL}_{\text{delta}} + \text{PL}_{\text{gamma}} + \text{PL}_{\text{theta}} + \text{PL}_{\text{volga}} + \text{PL}_{\text{vanna}} + \text{PL}_{\text{vega}} + \text{PL}_{\text{rho}}$

$\text{PL}_{\textbf{unexplained}} = \text{BoDPL} - \text{PL}_{\text{greeks}}$

$\text{PL}_{\textbf{mtm}} = \text{PL}_{\text{delta}} + \text{PL}_{\text{vega}} + \text{PL}_{\text{rho}}$

$\text{PL}_{\textbf{carry}} = \text{PL}_{\text{gamma}} + \text{PL}_{\text{theta}} + \text{PL}_{\text{volga}} + \text{PL}_{\text{vanna}}$