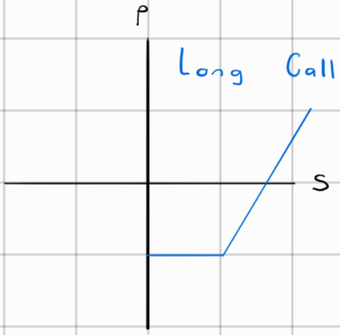
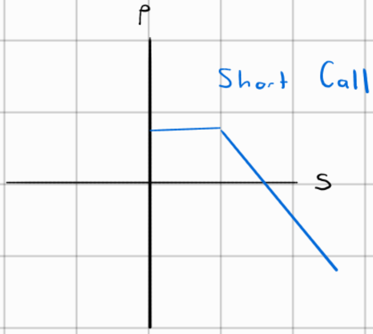
Conocimiento Previo :

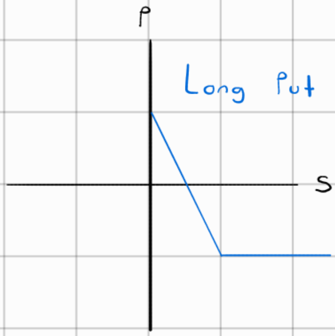
Delta de una opción : $\Delta = \dfrac{C_{t+1} - C_t}{S_{t+1} - S_t}$

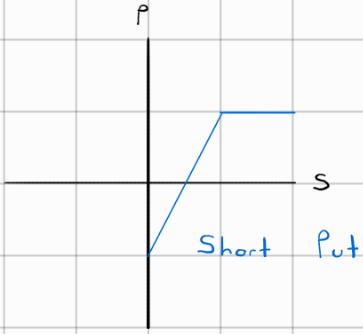
Delta Portafolio : $\delta_i = \dfrac{\Delta V}{\Delta S_i}$ ← Activo i

Posiciones en opciones :









VaR de la opción (Paramétrico) :

$$P\left[C_{t+1} - C_t < VaR\right] \leq \alpha$$

$$P\left[\Delta\left(S_{t+1} - S_t\right) < VaR\right] \leq \alpha$$

Si $\Delta > \emptyset$:

$$P\left[S_{t+1} - S_t < \frac{VaR}{\Delta}\right] \leq \alpha$$

$$S_t\left(1+R_{t+1}\right) = S_{t+1}$$

$$\downarrow$$

$$R_{t+1} \sim N\left(\mu_R , \sigma^2_R\right)$$

$$P\left[S_t\left(1+R_{t+1}\right) - S_t < \frac{VaR}{\Delta}\right] \leq \alpha$$

$$P\left[S_t R_{t+1} < \frac{VaR}{\Delta}\right] \leq \alpha$$

$$P\left[R_{t+1} < \frac{VaR}{\Delta S_t}\right] \leq \alpha$$

$$P\left[Z < \frac{\frac{VaR}{\Delta S_t} - \mu_R}{\sigma_R}\right] \leq \alpha \longrightarrow \frac{\frac{VaR}{\Delta S_t} - \mu_R}{\sigma_R} = Z_\alpha$$

$$VaR = \left(Z \sigma_R + \cancel{\mu_R}\right) \Delta S_t$$

$$VaR = Z_\alpha \sigma_R \Delta S_t$$

Si $\Delta < \emptyset$: $VaR = Z_{1-\alpha} \sigma_R \Delta S_t$

Portafolios de Opciones

- n opciones de un tipo :

$$VaR = n Z_\alpha \sigma_R \Delta S_t$$

- Opciones con diferentes subyacentes :

$$\Delta V = \sum_{i=1}^{n} S_i \delta_i \boxed{\Delta R_i}$$ ← Rendimiento del subyacente

$$V\left[\Delta V\right] = V\left[\sum_{i=1}^{n} S_i \delta_i \Delta R_i\right]$$

$$= \begin{bmatrix} S_1\delta_i & \cdots & S_n\delta_n \end{bmatrix} \begin{bmatrix} \sigma_1^2 & \cdots & \sigma_{n1} \\ \vdots & \ddots & \\ \sigma_{1n} & \cdots & \sigma_n^2 \end{bmatrix} \begin{bmatrix} S_1\delta_1 \\ \vdots \\ S_n\delta_n \end{bmatrix}$$ ← Varianza del Portafolio en términos monetarios

$$VaR = Z_\alpha \boxed{V_0 \, \sigma_p}$$

$$VaR = Z_\alpha \sqrt{V[\Delta V]}$$