

### 3. Interview questions

1. The option with lower gamma has higher VaR

$dp = \Delta \cdot ds + \frac{1}{2} \Gamma \cdot (ds)^2$ , with larger gamma, the second term will be larger, so that  $dp$  is larger.  $p(dp < -\text{VaR}) = 0.01$   $p(-dp > \text{VaR}) = 0.01$

2.  $\frac{dr_1}{r_1} = udt + \sigma dW$   $r_2 = \frac{1}{r_1}$  so that VaR is smaller with larger gamma.

Ito's lemma.  $dr_2 = \frac{\partial r_2}{\partial t} \cdot dt + \frac{\partial r_2}{\partial r_1} dr_1 + \frac{1}{2} \frac{\partial^2 r_2}{\partial r_1^2} (dr_1)^2$

$$= 0 + -\frac{1}{r_1^2} \cdot (u dt \cdot r_1 + \sigma r_1 dW) + \frac{1}{2} \times 2 \cdot \frac{1}{r_1^3} \cdot \sigma^2 r_1^2 dt$$

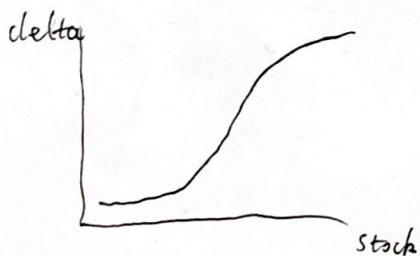
$$= -\frac{1}{r_1} \cdot u dt + \frac{1}{r_1} \cdot \sigma^2 dt - \frac{1}{r_1} \cdot \sigma dW$$

$$= (\sigma^2 - u) \cdot r_2 dt - r_2 \cdot \sigma dW$$

$$\frac{dr_2}{r_2} = (\sigma^2 - u) dt - \sigma dW$$

$$\text{drift} = \sigma^2 - u \quad \text{volatility} = \sigma$$

3. You should buy stock and borrow.



At first delta neutral.

$$\text{Total delta} = 0$$

Stock price decreases, and option delta will decrease as well.

Total delta will be negative.

In order to adjust the hedge to delta = 0 again.

You should buy stock, whose delta is 1.

Therefore, you should buy stock and borrow.