Q1-B

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Question - Yara inc is listed on the NYSE with a stock price of $40 - the company is not known to pay dividends. We need to price the call option with a strike of $45 maturing in 4 months. The continuously compounded risk-free rate is 3%/year, the mean return on the stock is 7%/year, and the standard deviation on the stock return is 40%/year What is is the Black-Scholes call price?

Answer -

The Black-Scholes Call Option pricing model is given by the formula

$$C = S_t N(d_1) - Ke^{rt} N(d_2)$$

where

$$d_1 = \frac{ln\frac{S_t}{K} + \left(r + \frac{\sigma^2}{2}\right) t}{\sigma\sqrt{t}}$$

and

$$d_2 = d_1 - \sigma\sqrt{t}$$

Equation terms

- $S_t = 40$
- $K = 45$
- $r = 0.03$
- $t = 3/12 = 0.25$
- $\sigma = 0.4$
- $N = \text{CDF of Normal distribution} = \frac{1}{2}\left[1 + erf\left(\frac{x}{\sqrt{2}}\right)\right]$

Calculating the term d_1

$$d_1 = \frac{ln\frac{40}{45} + \left(0.03 + \frac{0.4^2}{2}\right) * 0.25}{0.4 * \sqrt{0.25}} = -0.451415$$

Calculating the term d_2

$$d_2 = -0.451415 - (0.4 * \sqrt{0.25}) = -0.651415$$

finally, calculating C

$$C = 40 \cdot N(-0.451415) - 45 \cdot e^{0.03*0.25} \cdot N(-0.651415) = \underline{\$1.538}$$