Finance

Question 2

C = SN(d_1) – Ke^{-rt}N(d_2)

$$d_1 = \frac{In\left(\frac{S}{K}\right)+\left(\mathrm{r}+\frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}$$

$$d_2 = \frac{In\left(\frac{S}{K}\right)+\left(\mathrm{r}-\frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T}$$

Data provided in the question

S, Stock price = \$40; K, strike = \$45; T, maturity = 0.33 (converted to years);

r, continuously compounded risk-free rate = 0.03 (3%),

σ, standard deviation = 0.4 (40%)

substituting these into d_1, we have:

$$d_1 = \frac{In\left(\frac{\$40}{\$45}\right)+\left(0.03+\frac{0.4^2}{2}\right)0.33}{0.4\sqrt{0.33}}$$

$$d_1 = \frac{In(0.8889)+(0.03+0.08)0.33}{0.2298}$$

$$d_1 = \frac{-0.1178+(0.11)0.33}{0.2298}$$

$$d_1 = \frac{-0.1178+0.0363}{0.2298}$$

$$d_1 = \frac{-0.0815}{0.2298}$$

d_1 = -0.354656

d_1 ≈ 0.35

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

d_2 = -0.3547 – 0.2298

d_2 = -0.5848

d_2 ≈ -0.58

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Checking for the values of $N(d_1)$ and $N(d_2)$ in a normal distribution table, we have:

$N(d_1) = 0.3632$
$N(d_2) = 0.2810$
$e^{-rt} = 0.9901$

Substituting these values into Black-Scholes equation above

C = \$40 x 0.3632 – (\$45 x 0.2810 x 0.9901)
C = \$14.528 - \$ 12.5198
C = \$2.008
C ≈ \$2.01 (to 2 d.p)

Therefore, the Brown-Scholes call price is \$2.01

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