

The Black-Scholes Formulas for European Option on Discrete Dividend-Paying Stock

Dividend-adjusted stock price

$$c = (S_0 - De^{-rt}) N(d_1) - K e^{-rT} N(d_2)$$

$$p = K e^{-rT} N(-d_2) - (S_0 - De^{-rt}) N(-d_1)$$

$$\text{where } d_1 = \frac{\ln((S_0 - De^{-rt}) / K) + (r + \sigma^2 / 2)T}{\sigma \sqrt{T}}$$

$$d_2 = d_1 - \sigma \sqrt{T}, \text{ and}$$

De^{-rt} is the present value of all cash dividends that will be paid before option expiration date

$N(\cdot)$ the cumulative standard normal distribution function

$$N(-d_1) = 1 - N(d_1)$$

Exogenous Variables : $S_0, D, r, t, K, T, \sigma$ Endogenous Variables: d_1, d_2, c, p

In order to calculate c and p , we have to know the value of d_1 and d_2 .

First, calculation of d_1 and d_2 .

By coding, we can have the result of $d_1 = 0.511$; $d_2 = 0.266$.

Then we can plug the result back into the equation.

Second, calculation of c and p .

Where we got the final answer: $c = 12.624$, $p = 2.705$.