

EXAM MFE QUESTIONS OF THE WEEK

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Week of April 2/07

A stock has a current price of 100. The stock has annual volatility of $\sigma = .2$.

The continuously compounded risk free rate is $r = .05$. Apply the Black-Scholes option pricing formula to find the price of a European call option with strike price 100 expiring in 1 year in each of the following cases.

- (a) The stock pays continuous dividends at the rate of $\delta = .1$.
- (b) The stock pays a discrete dividend of 10 in 1 month.

The solution can be found below.

Week of April 2/07 - Solution

(a) Using prepaid forward prices $F_{0,1}^P(S) = 100e^{-.1}$ for the stock and

$F_{0,1}^P(K) = 100e^{-.05}$ for the strike price, we get

$$d_1 = \frac{\ln(100e^{-.1}/100e^{-.05}) + \frac{1}{2}(.04)}{.2} = -.15 \text{ and } d_2 = -.15 - .2 = -.35 .$$

$\Phi(-.15) = .4404$ and $\Phi(-.35) = .3632$.

The option price is $100e^{-.1}(.4404) - 100e^{-.05}(.3632) = 5.30$.

(b) Using prepaid forward prices $F_{0,1}^P(S) = 100 - 10e^{-.05/12} = 90.041580$ for the stock and

$F_{0,1}^P(K) = 100e^{-.05}$ for the strike price, we get

$$d_1 = \frac{\ln(90.041580/100e^{-.05}) + \frac{1}{2}(.04)}{.2} = -.1745 \text{ and } d_2 = -.1745 - .2 = -.3745 .$$

$\Phi(-.1745) = .4307$ and $\Phi(-.3745) = .3540$.

The option price is $90.0416(.4307) - 100e^{-.05}(.3540) = 5.11$.