Option Contracts

Moneyness and intrinsic value

❖**In the money option:** Is an option that would provide a positive payoff if exercised

❖**Out of the money option:** Is an option that would provide a negative payoff if exercised

❖**At the money option:** Is an option that would breakeven payoff if exercised

Valuation of Options

Option Valuation Models

- ❖Binomial model
- ❖Black Scholes Merton Model (BSM)

Valuation of Options

Let the stock values for the up-move and down-move be S_1^+ and S_1^- and for the call values, C_1^+ and C_1^-.

One-Period Call Option with X = $30

$\pi_U = 0.55$

$S_1^+ = \$30 \times 1.333 = \$40.00$

$C_1^+ = \max(0, \$40 - \$30) = \$10.00$

$S_0 = \$30$

$S_1^- = \$30 \times 0.750 = \$22.50$

$C_1^- = \max(0, \$22.50 - \$30) = \$0$

$\pi_D = 0.45$

Today

1 year

Valuation of Options

We know the value of the option at expiration in each state is equal to max (0, stock price – exercise price):

$$C_2^{++} = \max(0, \$78.13 - \$45.00) = \$33.13$$

$$C_2^{-+} = \max(0, \$50.00 - \$45.00) = \$5.00$$

$$C_2^{+-} = \max(0, \$50.00 - \$45.00) = \$5.00$$

$$C_2^{--} = \max(0, \$32.00 - \$45.00) = \$0$$

Valuation of Option Contracts

Now we know the value of the option in both the up-state (C_1^+) and the down-state (C_1^-) one period from now. To get the value of the option today, we simply apply our methodology one more time. Therefore, bringing (C_1^+) and (C_1^-) back one more period to the present, the *value of the call option today* is:

$$C_0 = \frac{(\pi_U \times C^+) + (\pi_D \times C^-)}{1+R_f} = \frac{E(\text{call option value})}{1+R_f}$$

$$= \frac{(0.6 \times \$20.45) + (0.4 \times \$2.80)}{1.07}$$

$$= \frac{\$13.39}{1.07} = \$12.51$$