8.1

Properties of Stock Option Prices

Chapter 8

8.2

Notation

- c : European call option price
- p : European put option price
- S_0 :Stock price today
- K : Strike price
- T : Life of option
- σ: Volatility of stock price
- C : American Call option price
- P : American Put option price
- S_T :Stock price at option maturity
- D : Present value of dividends during option's life
- r : Risk-free rate for maturity T with cont comp

8.3

Effect of Variables on Option Pricing (Table 8.1, page 168)

Variable	c	p	C	P
S_0	+	−	+	−
K	−	+	−	+
T	?	?	+	+
σ	+	+	+	+
r	+	−	+	−
D	−	+	−	+

8.4

American vs European Options

An American option is worth at least as much as the corresponding European option

$$C \geq c$$
$$P \geq p$$

8.5

Calls: An Arbitrage Opportunity?

- Suppose that

  $c = 3$ $S_0 = 20$

  $T = 1$ $r = 10\%$

  $K = 18$ $D = 0$

- Is there an arbitrage opportunity?

8.6

Lower Bound for European Call Option Prices; No Dividends

(Equation 8.1, page 173)

$$c \geq S_0 - Ke^{-rT}$$

8.7

Puts: An Arbitrage Opportunity?

- Suppose that

  $p = 1$ $\quad S_0 = 37$ $\quad T = 0.5$

  $r = 5\%$

  $K = 40$ $\quad D = 0$

- Is there an arbitrage opportunity?

8.8

Lower Bound for European Put Prices; No Dividends

(Equation 8.2, page 174)

$$p \geq Ke^{-rT} - S_0$$

8.9

Put-Call Parity; No Dividends

(Equation 8.3, page 174)

- Consider the following 2 portfolios:
  - Portfolio A: European call on a stock + PV of the strike price in cash
  - Portfolio C: European put on the stock + the stock
- Both are worth MAX(S_T , K) at the maturity of the options
- They must therefore be worth the same today
  - This means that

$$c + Ke^{-rT} = p + S_0$$

8.10

Arbitrage Opportunities

- Suppose that

  $c = 3$ $\quad S_0 = 31$

  $T = 0.25$ $\quad r = 10\%$

  $K = 30$ $\quad D = 0$

- What are the arbitrage possibilities when

  $p = 2.25$?

  $p = 1$?

8.11

Early Exercise

- Usually there is some chance that an American option will be exercised early
- An exception is an American call on a non-dividend paying stock
- This should never be exercised early

8.12

An Extreme Situation

- For an American call option:

$S_0 = 100$; $T = 0.25$; $K = 60$; $D = 0$

Should you exercise immediately?

- What should you do if
  1. You want to hold the stock for the next 3 months?
  2. You do not feel that the stock is worth holding for the next 3 months?

Reasons For Not Exercising a Call Early (No Dividends)

- No income is sacrificed
- We delay paying the strike price
- Holding the call provides insurance against stock price falling below strike price

Should Puts Be Exercised Early ?

Are there any advantages to exercising an American put when

$S_0 = 60$; $T = 0.25$; r=10%

$K = 100$; $D = 0$

The Impact of Dividends on Lower Bounds to Option Prices

(Equations 8.5 and 8.6, page 179)

$$c \geq S_0 - D - Ke^{-rT}$$

$$p \geq D + Ke^{-rT} - S_0$$

Extensions of Put-Call Parity

- American options; $D = 0$
  $S_0 - K \leq C - P \leq S_0 - Ke^{-rT}$
  Equation 8.4 p. 175
- European options; $D > 0$
  $c + D + Ke^{-rT} = p + S_0$
  Equation 8.7 p. 179
- American options; $D > 0$
  $S_0 - D - K \leq C - P \leq S_0 - Ke^{-rT}$
  Equation 8.8 p. 179