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Problem Set 9

Foundations of Financial Markets

Due date: 28^{th} **November 2007 in class**

1. You want to buy a stock that is currently selling for \$60. You forecast that in one year the stock price will be either \$110 or \$20. There is a one year option on the stock available with an exercise price of \$80. You are able to borrow at a rate of 6.5%. You would like to hedge your stock position using the call option.
   (a) What will be the call's value if the stock price is \$110 in one year? What will be the call's value if the stock price is \$20 in one year?
   (b) What is the hedge ratio you should use?
   (c) Assume that you can purchase fractional shares of the stock. How many shares of the stock would you buy? What position would you take in the option?
   (d) What will be the value of your portfolio (combined stock and option position) in one year if the stock's price turns out to be \$110? What will be the value of your portfolio if the stock price turns out to be \$20?
   (e) What is the present value of the amount you found in part d?
   (f) What is the value of the call option today?
   (g) Suppose that the call option is selling for \$14.50, instead. How would you combine options with one share of stock to make arbitrage profits? (Please detail the cash flows of this strategy)
2. A share of DoublePlay.com is selling at \$100. You forecast that this value can either go up to \$200 or drop to \$50 tomorrow. You want to verify whether a put option with strike price \$125 is fairly priced. Assume that the risk-free rate is 8%.
   (a) Construct a perfectly hedged portfolio by mixing shares of the stock and put options. (Hint: define the hedge ratio as $H = -\frac{P_u - P_d}{S_u - S_d}$ where P_u is the value of the put if the stock price goes up, P_d is the value of the call if the stock price goes down, and S_u and S_d are the stock prices in the same two scenarios. Buy H shares of the stock and one put and verify that this is a perfectly hedged position.)

(b) What is the present value of your perfectly hedged portfolio?

(c) What is the put price that would rule out arbitrage opportunities?

(d) Assume that DoublePlay.com does not pay dividends. What is the price of a call option with strike price $125 (Hint: use the call-put parity)? Does it look like the one that we computed in class?

3. Use the Black and Scholes formula to find the value of a call option based on the following inputs.

Stock Price	$57.00
Exercise Price	$63.00
Interest Rate	.08
Dividend Yield	.04
Time to expiration	.5
Standard Deviation of Stock's return	.27

4. Find the value of the call option based on the inputs from the previous problems, but...

(a) ... change the stock price to $67. How does the value of the call change? Why does the result make sense?

(b) ... change the interest rate to 5%.How does the value of the call change? Why does the result make sense?

(c) ... change the standard deviation of the stock's return to 0.46. How does the value of the call change? Why does the result make sense?