

# Problem Set 10

## Foundations of Financial Markets

**Due date: 5<sup>th</sup> December 2007 in class**

1. A European put option has an exercise price of \$62 and four months to expiration. The underlying stock is selling for \$64 currently and pays an annual dividend of \$1.92. The standard deviation of the stock's return is 0.21 and the risk free rate is 5%.
  - (a) Use the Black and Scholes model to find the price of the put option.
  - (b) What is the hedge ratio (Delta) of the put option?
  - (c) Suppose that the price of the stock increases to \$65. Use your answer to part b to calculate the new price of the put option.
  
2. If the initial margin on an orange juice futures contract is 15% and the settlement price is 99.4 cents per lb., with a contract size of 15,000 lbs., how much must you deposit in your account to meet the initial margin requirement? Suppose that you held a short position open for eight days, then reversed the trade. Complete the following table, which shows how your account would be marked to market each day as the price of the futures contract fluctuates. Confirm that the total of the mark-to-market values equals the ending price of the contract minus the beginning price of the contract, times the units.

Day	Futures Price (cents per lb.)	Profit or Loss (cents per lb.)	Daily Proceeds
0	99.4	-	-
1	101.2		
2	100.3		
3	99.2		
4	99.6		
5	98.8		
6	99.2		
7	98.6		
8	98.1		

3. Suppose that the maintenance margin on the orange juice futures contract mentioned in the previous problem is 10%. Answer the following questions.
- At what dollar value of margin would you expect to receive a margin call?
  - Will you receive a margin call if the futures price increases by \$0.03 per lb.?
  - Will you receive a margin call if the futures price increases by \$0.05 per lb.?
4. You are evaluating the relationship between the spot price and the futures price of palladium. The palladium currently sells for \$440 per troy oz. There is a futures contract that matures in two months with a price of \$444 per troy oz. The annual risk free rate is 3%.
- According to spot-futures parity, what should be the price of the futures contract?
  - Does an arbitrage opportunity exist? If so, describe the actions that you would take to exploit the opportunity, and determine the accompanying cash flows. Assume that the price will turn out to be \$446 per troy oz. at the expiration date of the futures contract.
  - If you follow your strategy from part b, what impact does the ending price of the palladium has on your profits?
  - Now assume that the futures price is \$440. Repeat your analysis from part b.
5. Consider a stock that will pay a dividend of  $D$  dollars in one year, which is when a futures contract matures. Consider the following strategy: buy the stock, short a futures contract on the stock, and borrow  $S_0$  dollars, where  $S_0$  is the current price of the stock. Assume that the one year risk free rate is  $r_f$ .
- What are the cash flows now and in one year? (Remember the dividend the stock will pay)
  - Show that the equilibrium futures price must be  $F_0 = S_0(1 + r) - D$  to avoid arbitrage.
  - Call the dividend yield  $d = D/S_0$  and conclude that  $F_0 = S_0(1 + r - d)$ .