

**UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN**  
**College of Business**  
**DEPARTMENT OF FINANCE**

**Fin 580 ERM**  
**Enterprise Risk Management**

Prof. Rick Gorvett  
Spring, 2008

**Homework Assignment # 2 (max. points = 10)**  
**Due at the beginning of class on Thursday, April 17, 2008**

You are encouraged to work on these problems in groups of no more than 3 or 4. However, each student must hand in her/his own answer sheet. Please write your final answers on the answer sheet provided, and turn in only the answer sheet.

Use the following data to answer questions (1) and (2).

Consider one European call option and one European put option, each on ABC stock. You are given the following information on ABC stock and the options:

$S$  = current value of ABC stock = 80

$X$  = exercise price of each option = 80

$r$  = continuously-compounded annual interest rate = 0.08, or 8%

$T$  = time to expiration of options = 0.50 year

$\sigma$  = continuously-compounded standard deviation of ABC stock returns = 0.30 or 30%

- (1) Use the Black-Scholes formula to determine the current price of the call option.
- (2) Use the put-call parity relationship to determine the current price of the put option.

Problems (3) through (5) concern a 3-year, 7% annual coupon bond with a face value of 1,000. Assume an annual effective interest rate of 6%.

- (3) Find the modified duration of this bond.
- (4) Find the convexity of this bond.
- (5) Suppose the annual effective interest rate increases by 100 basis points (i.e., increases from 6% to 7%). Find the difference between the true new price of the bond assuming 7%, and the duration-convexity prediction of the new price.

Problems (6) through (8) concern a 30-year, 8% annual coupon bond with a face value of 1,000. Assume an annual effective interest rate of 9%.

- (6) Find the modified duration of this bond.
- (7) Find the convexity of this bond.
- (8) Suppose the annual effective interest rate decreases by 100 basis points (i.e., decreases from 9% to 8%). Find the difference between the true new price of the bond assuming 8%, and the duration-convexity prediction of the new price.

For problems (9) and (10), use the data in the Excel spreadsheet posted on the class website. This spreadsheet contains 1,000 values simulated from an annual aggregate loss distribution to which a firm is subject. Suppose the firm has capital of \$ 1,250,000 with which to pay its annual aggregate losses. The firm will go bankrupt if the amount of annual aggregate losses exceeds the firm's capital.

- (9) Based on the 1,000 randomly sampled annual aggregate loss values, find the probability that the firm goes bankrupt.
- (10) Now suppose that the firm pays \$ 100,000 for a \$ 1 million in-excess-of \$1 million annual aggregate loss reinsurance cover. (In other words, the firm will pay the first million dollars of each annual loss, the reinsurer will pay the next million of each annual loss (that part of each loss between \$ 1,000,000 and \$2,000,000), and the firm will pay any part of each annual loss in excess of \$2 million. The amount of each annual loss that the firm ends up paying is referred to as the firm's "retained" loss.) Considering the original \$ 1,250,000 capital, the \$100,000 premium the firm pays to the reinsurer for the reinsurance cover, and the amount of each retained annual loss, find the probability that the firm goes bankrupt.

Name: \_\_\_\_\_

**Answer Sheet for Homework Assignment # 2**

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(1) \_\_\_\_\_

(2) \_\_\_\_\_

(3) \_\_\_\_\_

(4) \_\_\_\_\_

(5) \_\_\_\_\_

(6) \_\_\_\_\_

(7) \_\_\_\_\_

(8) \_\_\_\_\_

(9) \_\_\_\_\_

(10) \_\_\_\_\_